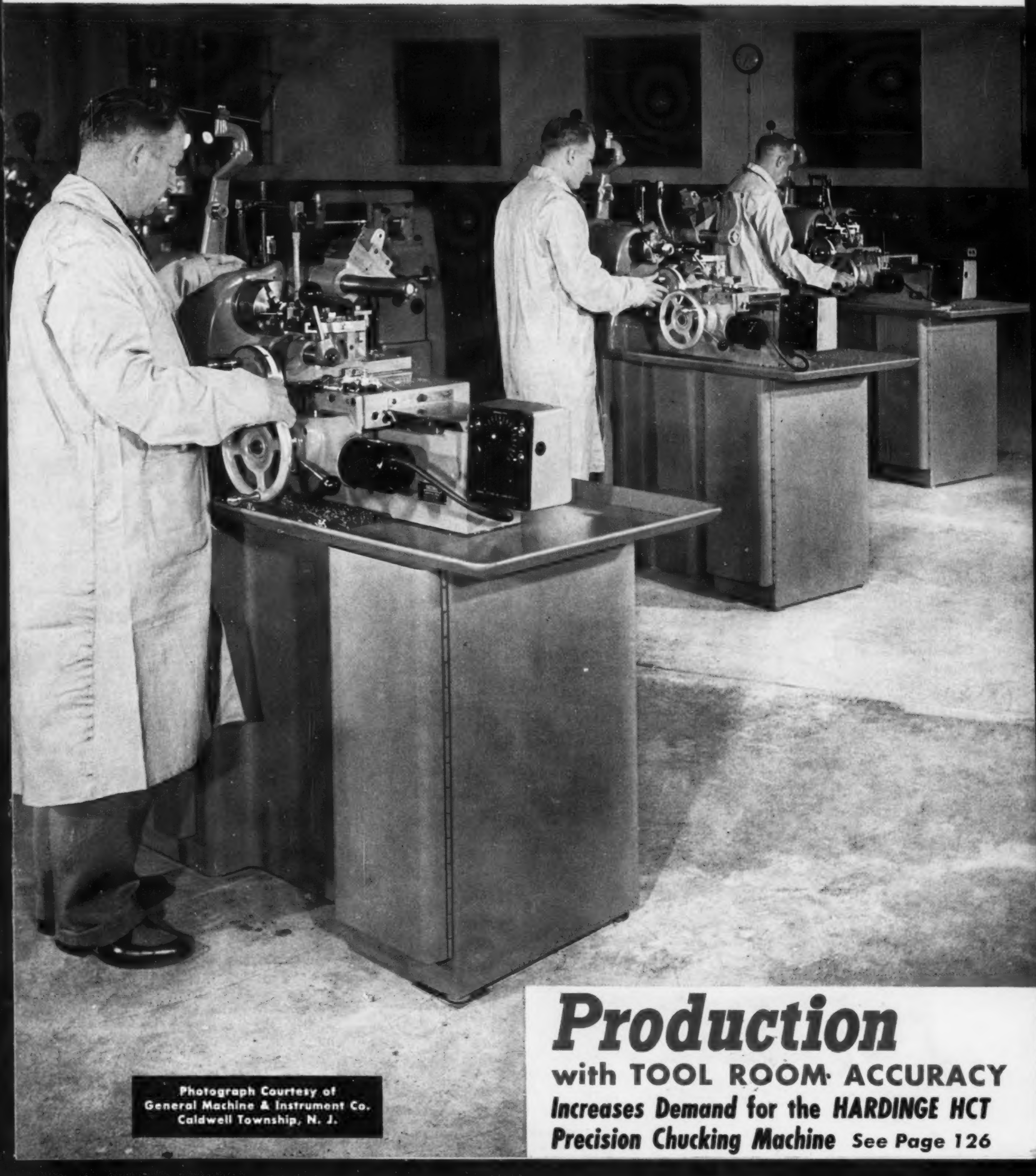
DECEMBER 1957—AUTOMOTIVE PRODUCTION NUMBER

Machinery



Photograph Courtesy of
General Machine & Instrument Co.
Caldwell Township, N. J.

Precision Chucking Machine See Page 128

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BPA NBP

Machinery

DECEMBER 1957 VOL. 64 NO. 4

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS AND MEETINGS

DEPARTMENTS

4500 pieces between grinds

....threading stainless steel on bar automatic

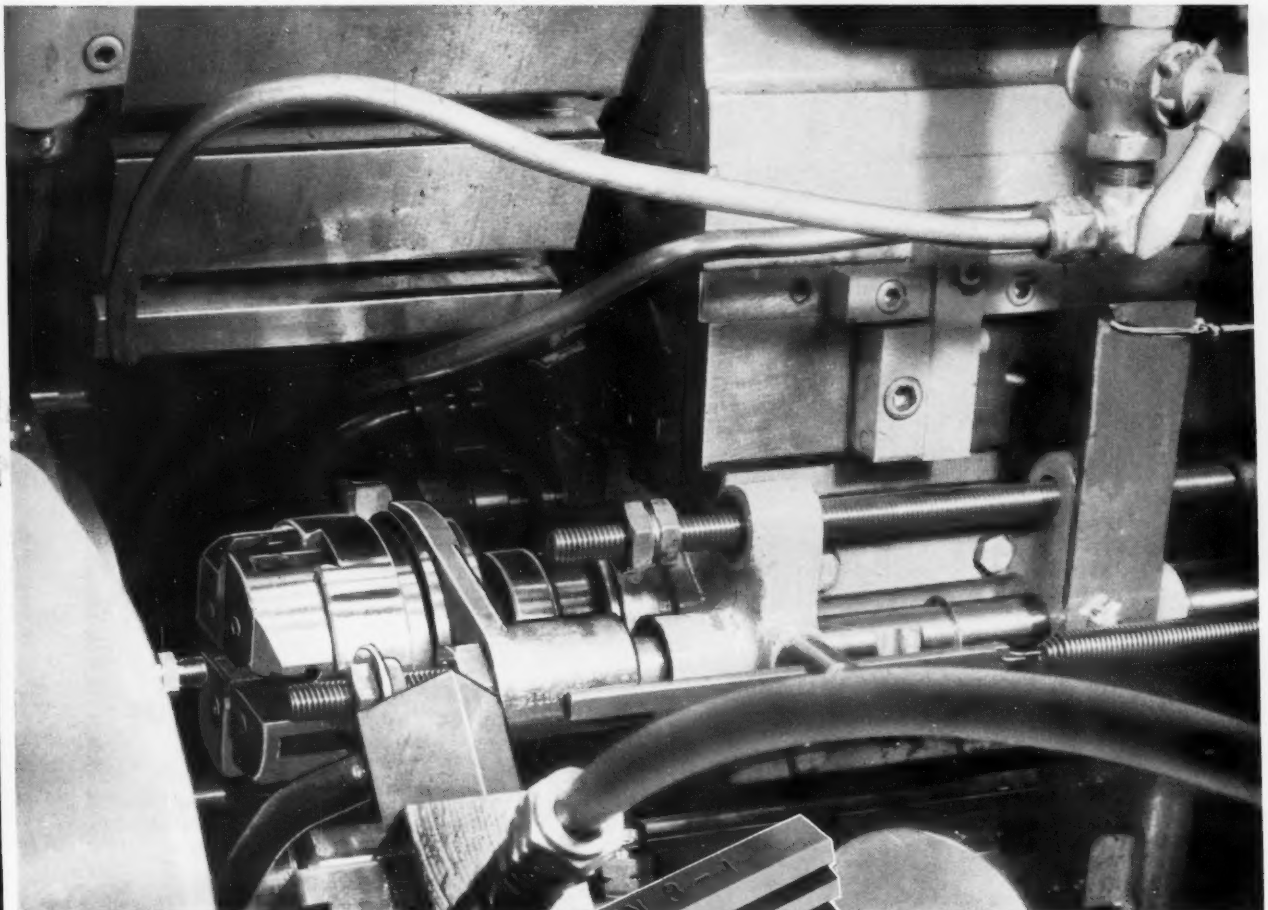
A LANDEX Hardened and Ground Die Head has maintained exceptional chaser life threading male connector tube fittings at the Crawford Fitting Co., exclusive user of LANDIS Equipment in Cleveland, Ohio.

7/16″ 20 pitch UNF threads were cut to Class 3 fit from 316 stainless steel by a 7LLL Head mounted on a six-spindle Warner & Swasey Bar Automatic. 144 pieces per hour were threaded 5/16″ long within 3/32″ of a shoulder at 19 to 20 SFM. 4500 pieces were produced between chaser grinds using 30° short throat chasers.

This outstanding tool life is the result of basic chaser design and over 50 years of LANDIS research and experience in manufacture and hardening. For example, to ensure satisfactory die life, chasers are given special hardening when workpiece design or material specifications so indicate.

Long life between grinds, as illustrated here at the Crawford Fitting Co., is one reason why the use of LANDIS Tangential Chasers ensures threading economy. It is further important to know that these chasers, requiring only a few thousandths metal removal to restore the cutting edge, are usable for 80% of their original length. In addition, it is not necessary to remove the same amount of metal from all chasers of a set, or to replace the entire set at the same time.

LANDEX Hardened and Ground Heads are unmatched for precision threading and true economy on bar automatics and other live-spindle machines with limited clearance. Let us show you how to improve threading operations—send specifications and ask for Bulletin F-80.



The world's largest
manufacturer of
threading equipment

CUTTING • GRINDING

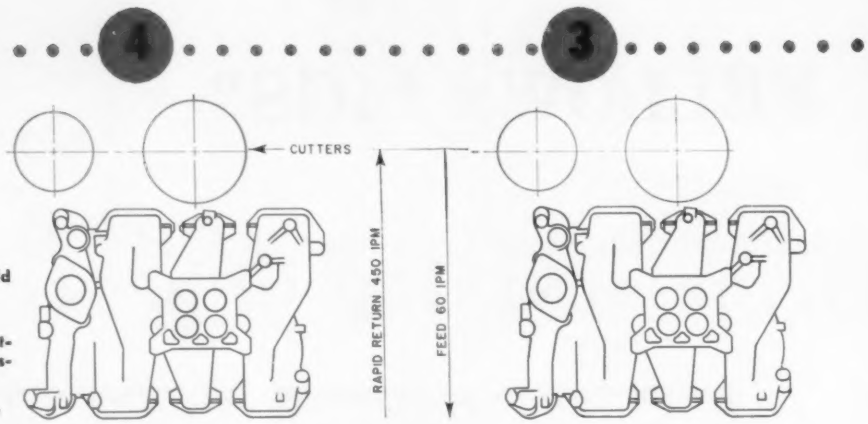
ROLLING • TAPPING

LANDIS Machine COMPANY

502C WAYNESBORO • PENNSYLVANIA • U.S.A.

For more information fill in page number on Inquiry Card, on page 233

For more information fill in page number on Inquiry Card, on page 233



Work flow drawing for CINCINNATI® 4-Station Automatic Transfer Machine.

Production Data

Part Name .... Intake Manifold

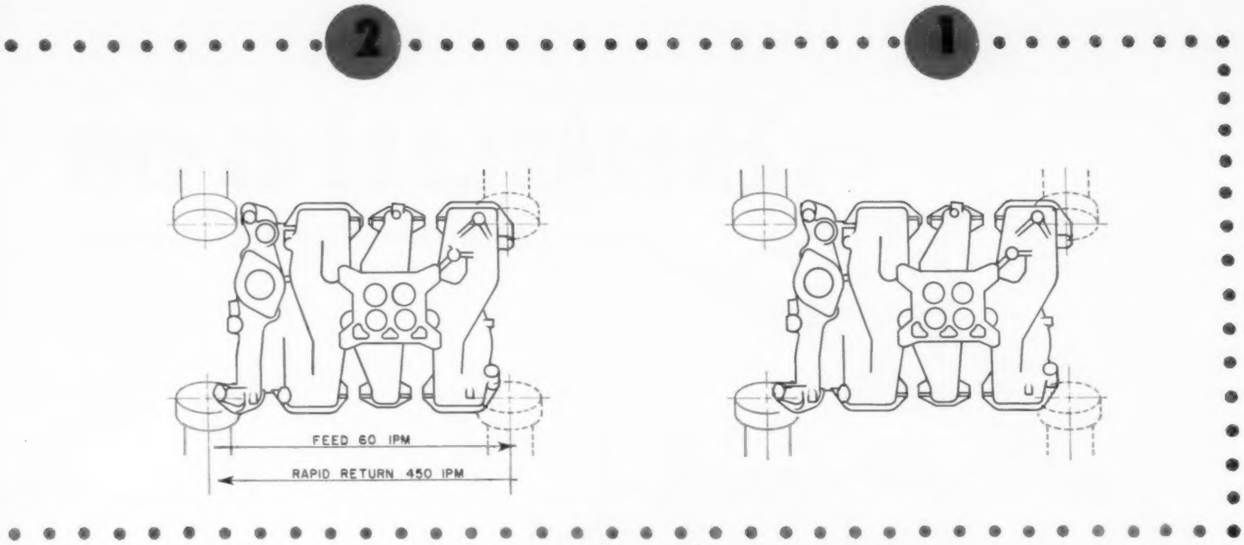
Material .... Cast Iron

Operations .. Mill 25° angular mounting pads and 5° accessory pads

Production .. 160 manifolds per hour

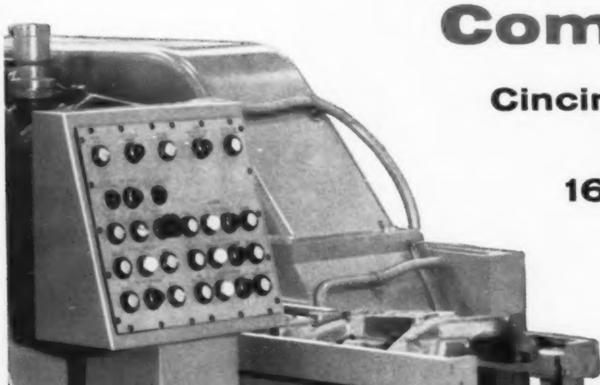
CINCINNATI

SPECIAL MACHINE TOOLS AND



Compact...Simplified

Cincinnati 4 Station Transfer Machine *Automatically Mills* 160 Intake Manifolds per hour



Straight-line progression of work reduces floor space required for transfer type machines; simplifies the transfer mechanism. Cincinnati Milling Specialists incorporated these advantages in the 4-Station Manifold Milling Machine illustrated here . . . there are no rollover or turntable units. The work progresses through four stations in a straight line. To attain this advantage, the spindles for the milling operations in stations 1 and 2 are mounted upside-down (see work flow drawing). Other advantages:

Hardened and ground ways . . . automatic lubrication

Center opening in bed for easy chip disposal

Fast rapid traverse at 450" per min., and feed rates up to 150" per min.

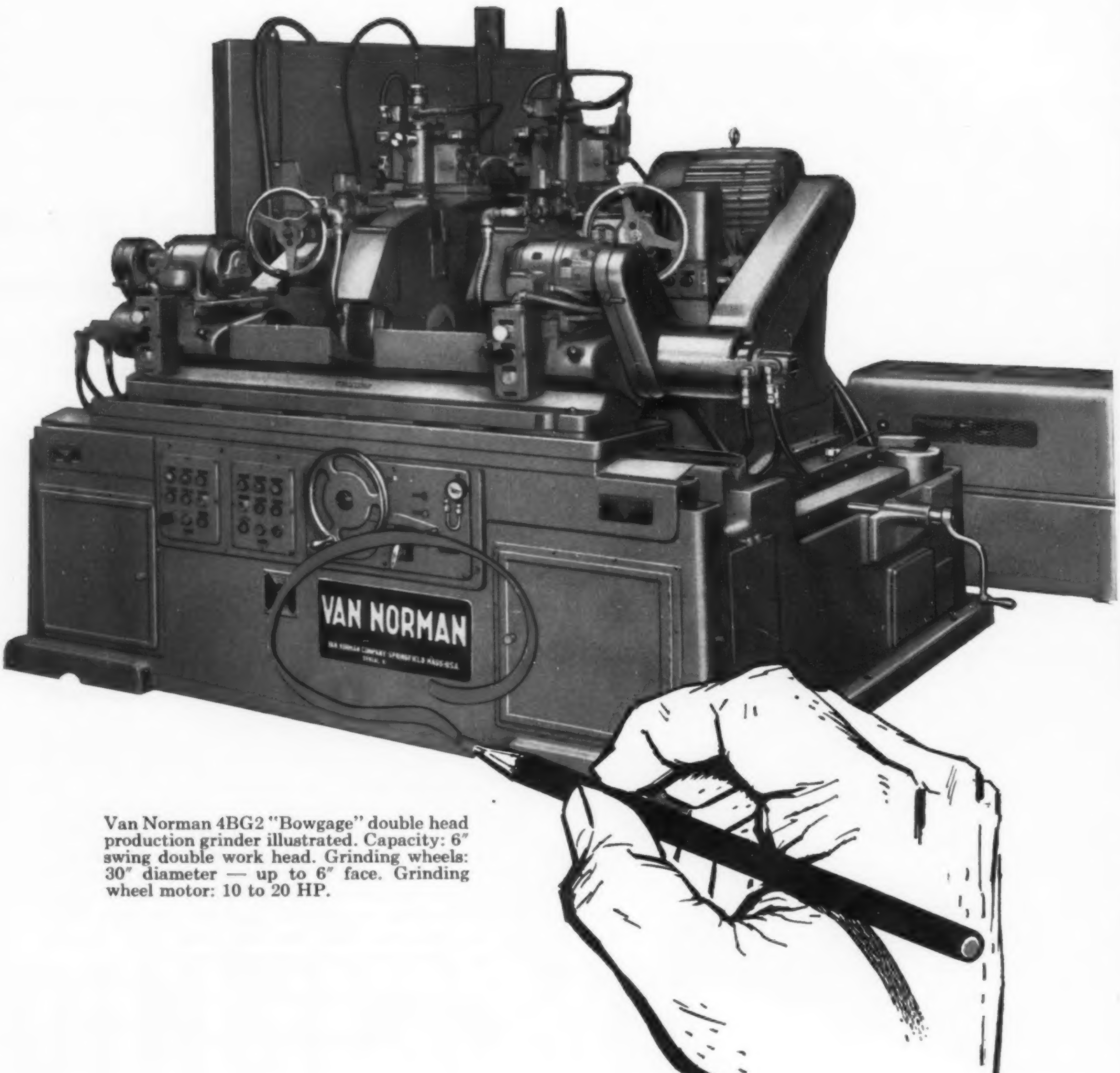
Cincinnati Special Machine Tool Division has the engineering experience and product background to give you the finest single-purpose, automated equipment available anywhere. Our automation specialists will be glad to investigate your methods and production procedures, and tell you how costs can be reduced. May we hear from you? Please enclose blueprints and complete details.

Special Machine Tool Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

COMPLETE PRODUCTION LINES

For more information fill in page number on Inquiry Card, on page 233

The Accent is on

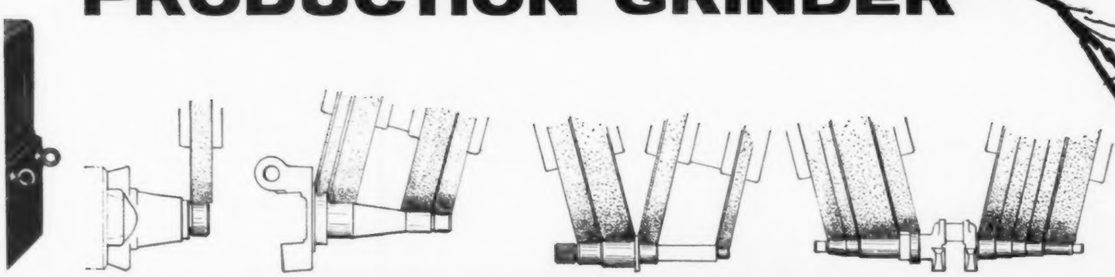


Van Norman 4BG2 "Bowgage" double head production grinder illustrated. Capacity: 6" swing double work head. Grinding wheels: 30" diameter — up to 6" face. Grinding wheel motor: 10 to 20 HP.

Production

when you use a

VAN NORMAN "BOWGAGE" PRODUCTION GRINDER



Here are sketches of several actual applications performed for users of single and double head Bowgage Production grinding machines.

"Engineered for the job," the Van Norman 4BG "Bowgage" Production Grinder gives you accurate, fast, economical mass production.

Actual case histories on these massive grinders continually show substantial savings by keeping production up and costs down.

Van Norman production grinders can help you with your mass production problems. Write, wire or telephone, today, for complete details on the Van Norman 4BG "Bowgage" Production Grinders.

Don't wait . . . for extra profit install a Van Norman "Bowgage" Production Grinder now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

VAN NORMAN MACHINE COMPANY

SPRINGFIELD 7, MASSACHUSETTS

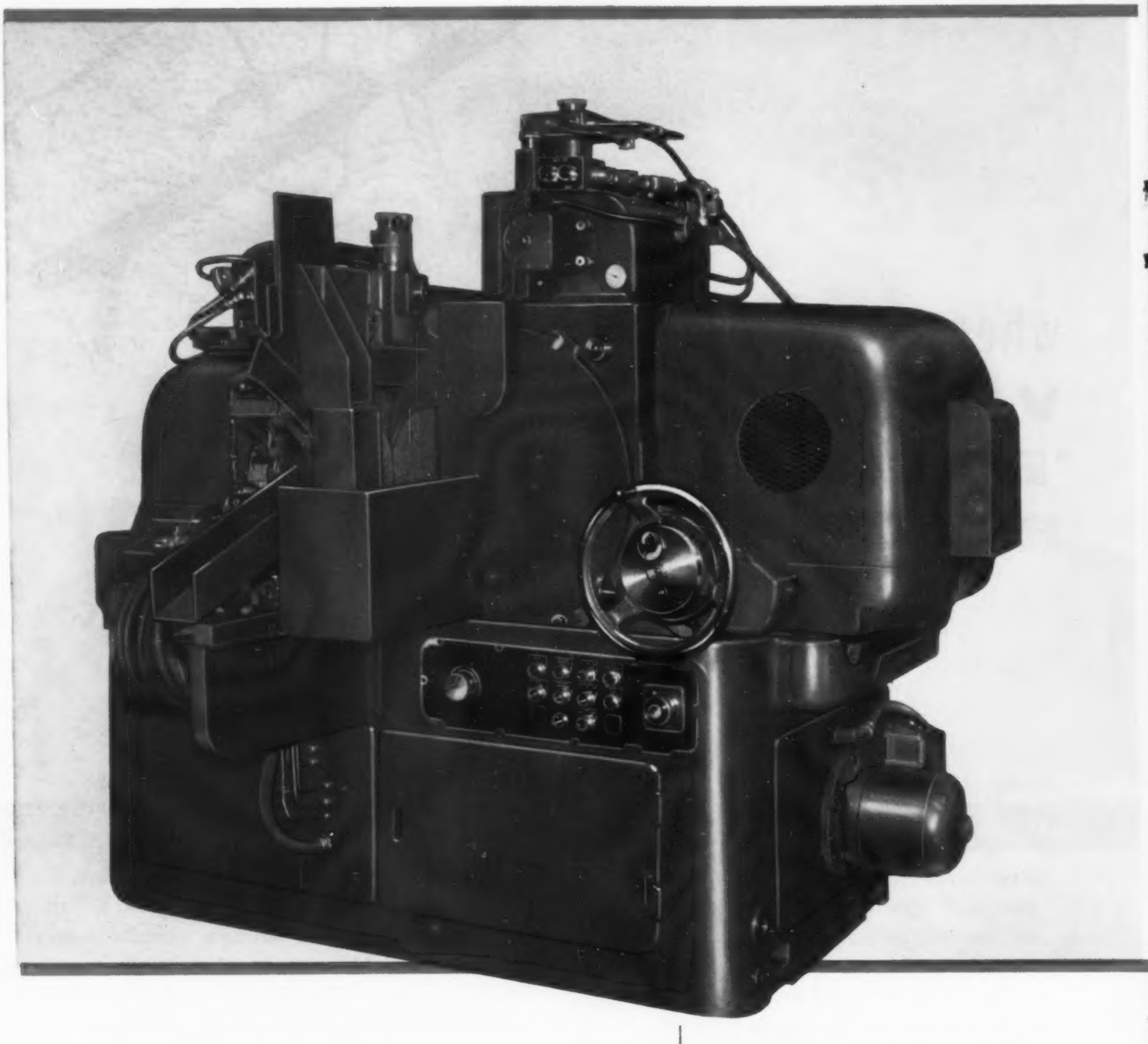
A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

For more information fill in page number on Inquiry Card, on page 233

Landis Centerless with automatic

. . . form grinds file blanks from straight stock;



Machine:	Landis No. 12½ Centerless Grinder
Part:	Five sizes of round files —high carbon steel
Operation:	Grinding from straight cylindrical blanks
Tooling:	Automatic loading and unloading
Size limit:	± .003″
Production:	288 to 382 per hour —depending on size of file

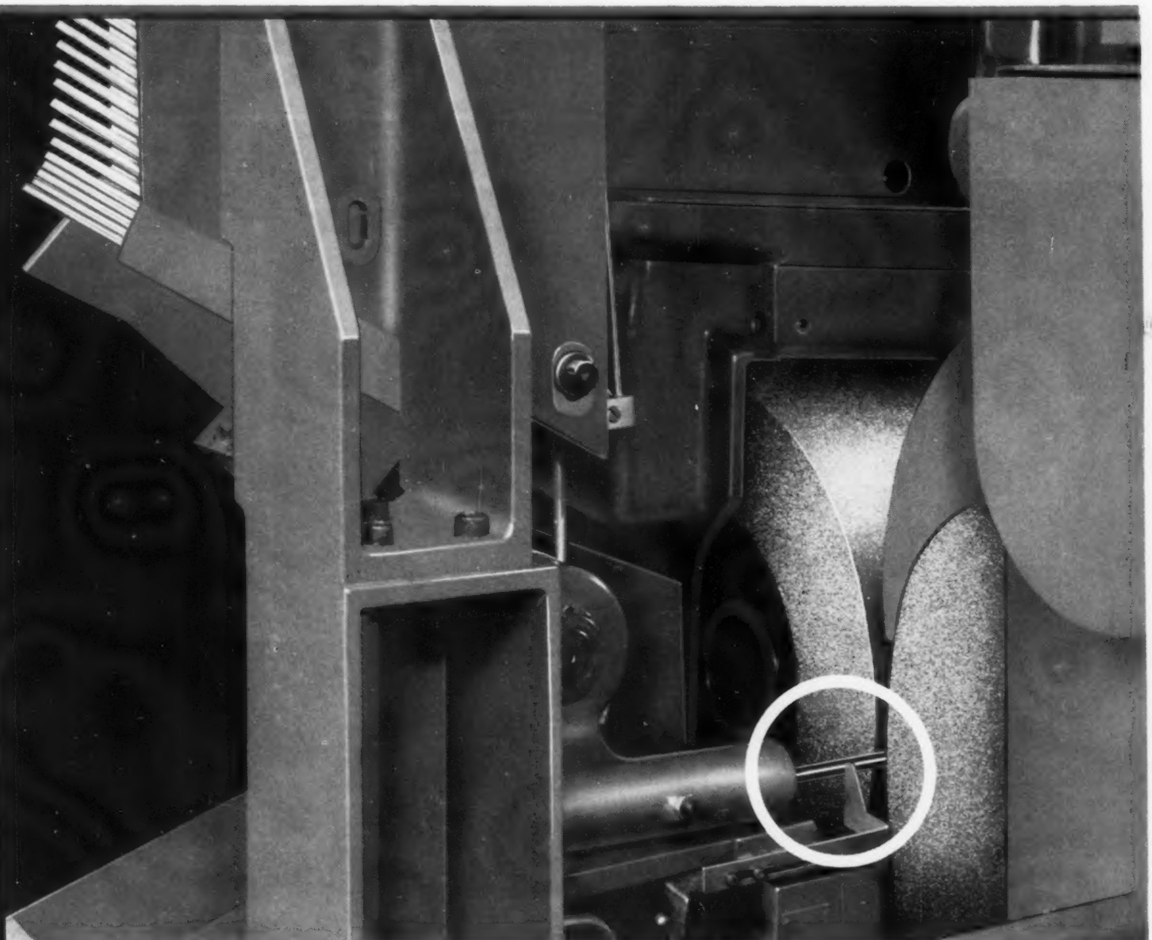
LANDIS

precision grinders

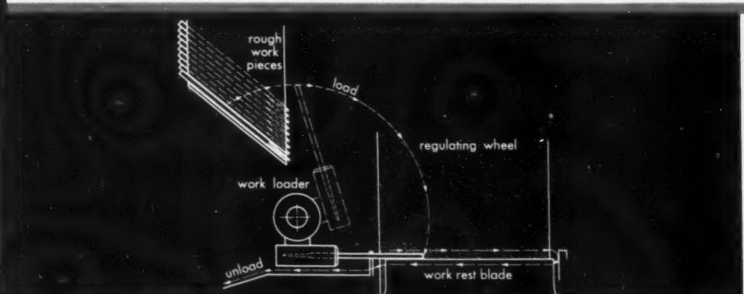
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

loader boosts production 144%

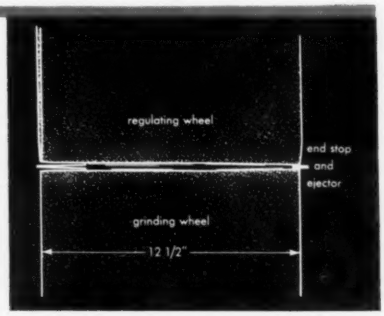
eliminates extra operations formerly required



LANDIS tooling engineered for this application provides automatic loading, cycling and discharge for considerable savings in time and costs. Photo shows workpiece during loading. This is followed by automatic grinding cycle and automatic discharge.



Automatic load and grind. Transfer arm takes workpiece from loading chute and places it between formed grinding and regulating wheels.

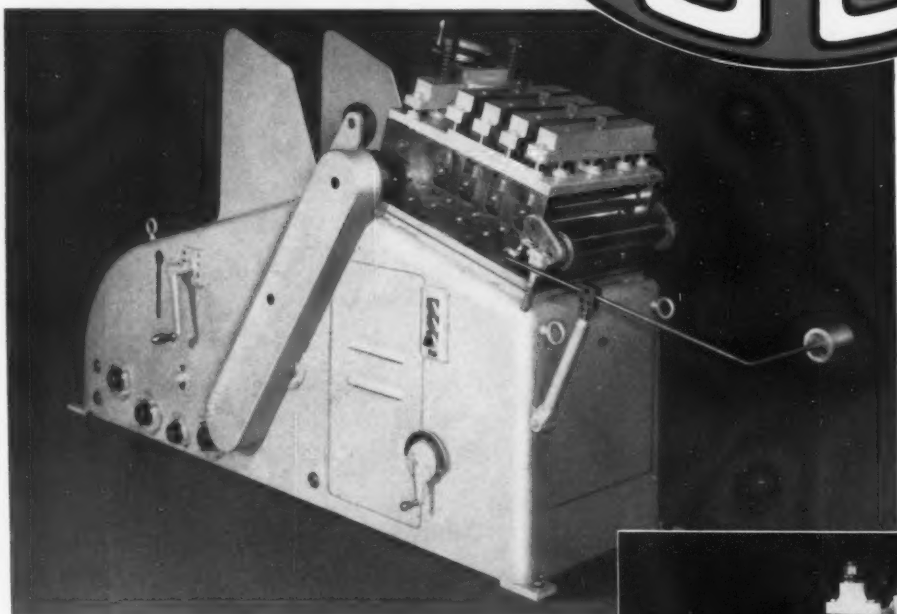


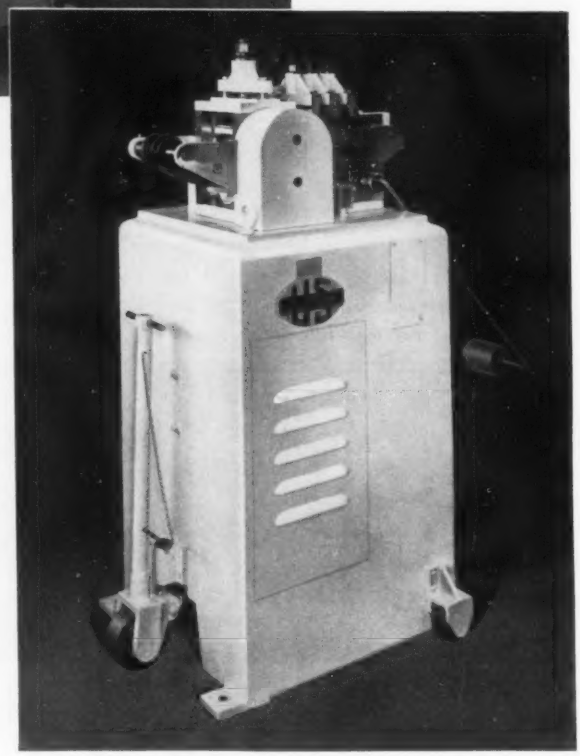
Using the end feed method, the file blank is ground to size. It trips the ejector at the positive stop.

STOCK REELS • SLIDE FEEDS • COIL CRADLES

WIRE STRAIGHTENERS

SPECIFY U S PRODUCTS





Above—Model PDSC-1648 U. S. Combination Coil Cradle—Power Driven Straightener, suitable for material up to 16 inches in width, coils with O.D. up to 48 inches, thickness capacity 1/8 inch.

Right—Model PDS-4 1/2 U. S. Power Driven Straightener, suitable for material up to 4 1/2 inches in width, thickness capacity 1/8 inch.

FLAT STOCK STRAIGHTENERS • STOCK OILERS

ROLL FEEDS • SCRAP CHOPPERS • MULTI-STOPS

FOR PROFITABLE COIL HANDLING

Units in the line of U. S. Automatic Press Room Equipment are designed to help you reduce stamping costs through the efficient use of stock in coils. Where floor space is at a premium, a unit like the Model PDSC-1648 Combination Coil Cradle—Power Driven Straightener, shown on the opposite page, can often be used in an area too small to accommodate a separate Straightener and Cradle.

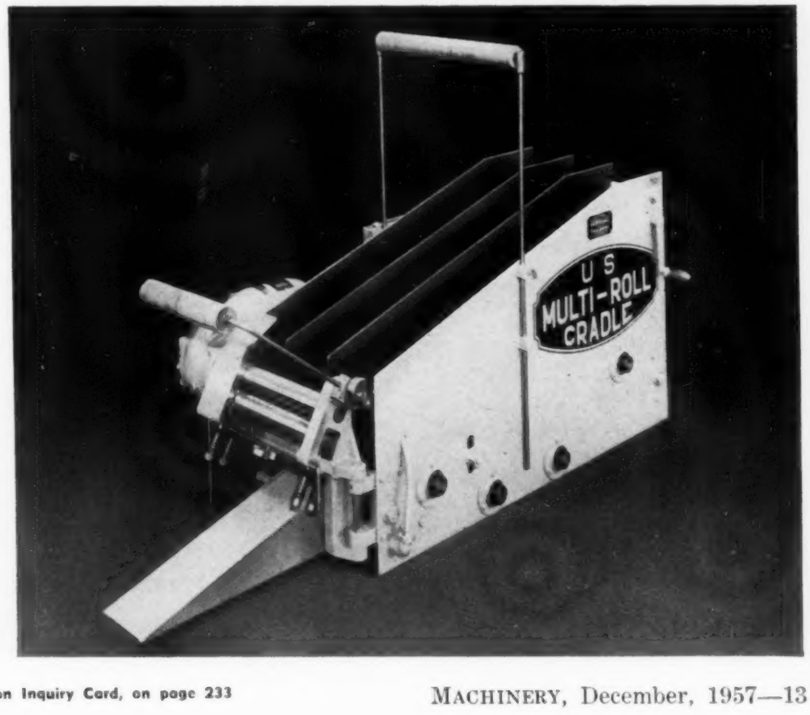
Satisfactory feeding into the press is often dependent upon: (1) the straightness of the stock, and (2) the manner in which the coil is supported and unwound. U. S. Stock Reels, Coil Cradles and Combination Units are built in a wide range of sizes and types to suit your particular requirements.

Ask for Bulletins 80-M and 95-M for detailing information on units in the line of U. S. Automatic Press Room Equipment.

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) **NEW JERSEY**

Right—Model ACC-1-9-C U. S. Multi-Roll Coil Cradle suitable for material up to 9 inches in width, O.D. up to 40 inches, weight capacity 1,500 lbs.



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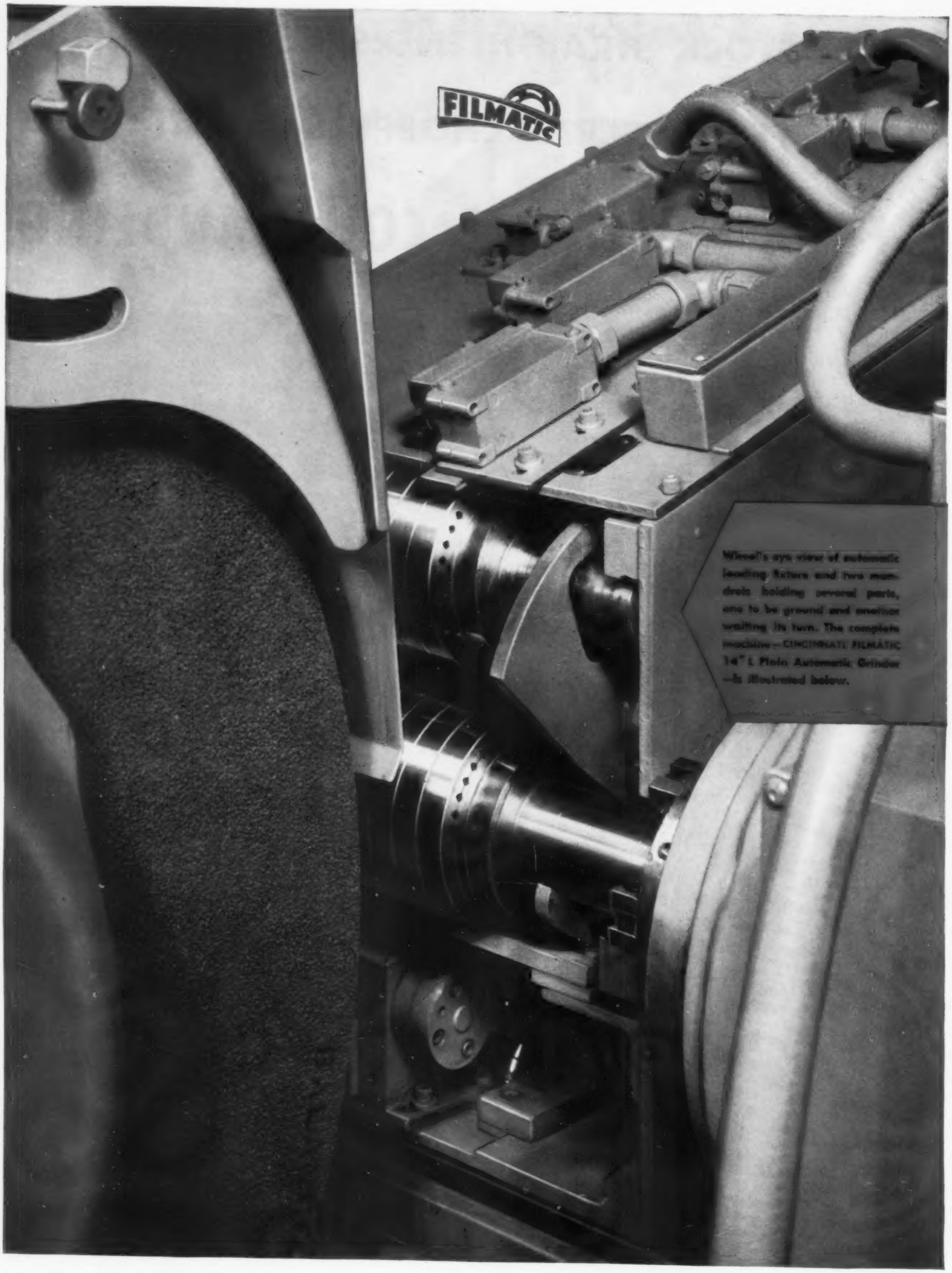
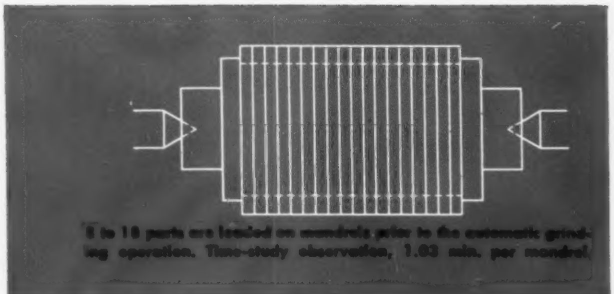
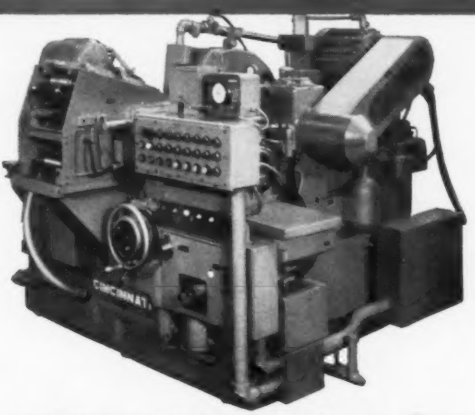

FILMATIC
Wheel's eye view of automatic loading fixture and two mandrels holding several parts, one to be ground and another waiting its turn. The complete machine—CINCINNATI FILMATIC 14" L Plain Automatic Grinder—is illustrated below.

Cincinnati Filmatic 14"L Plain Grinder

. . . automatically grinds and sizes narrow parts by the dozen



[illegible] to [illegible] parts are loaded on mandrels prior to the automatic grinding operation. Time-study observation, 1.03 min. per mandrel.



CINCINNATI FILMATIC 14"L Plain Hydraulic Grinding Machine, equipped for completely automatic infeed grinding operations.

Production methods dictated a centertype grinder, and good business judgment dictated a CINCINNATI with maximum automation to grind the O.D. of internal gears manufactured in big volume. A CINCINNATI® FILMATIC 14"L Plain Grinder, completely equipped for automatic grinding, does a highly profitable, dependable job. Features of low-cost operation include:

- **Automatic loading fixture**
- **Automatic grinding cycle**
- **Automatic air-electric gage sizing, with Cincinnati's exclusive cycle time stabilizer**
- **Automatic behind-the-wheel truing, incorporating cycle counter**
- **Automatic grinding wheel reciprocation, interlocked with the truing cycle**
- **Gap eliminator (reduces "cutting air" portion of infeed cycle)**
- **Hydraulic footstock**

FILMATIC grinding wheel spindle bearings, automatic wheel balancing and other standard features and construction characteristics tie the foregoing automation elements together to form a dependable, high production, controlled accuracy grinding machine. ¶ This precision centertype grinder is typical of the fine engineering developed by Cincinnati's Automation and Engineering Service specialists. These men are ready to give you the benefit of their experience in six distinct types of precision grinding: centertype, centerless, chucking, Micro-Centric, centerless lapping, roll. Make Cincinnati your headquarters for fine grinding machines built to your requirements. Metalworking plants throughout the world have found it profitable to do so.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

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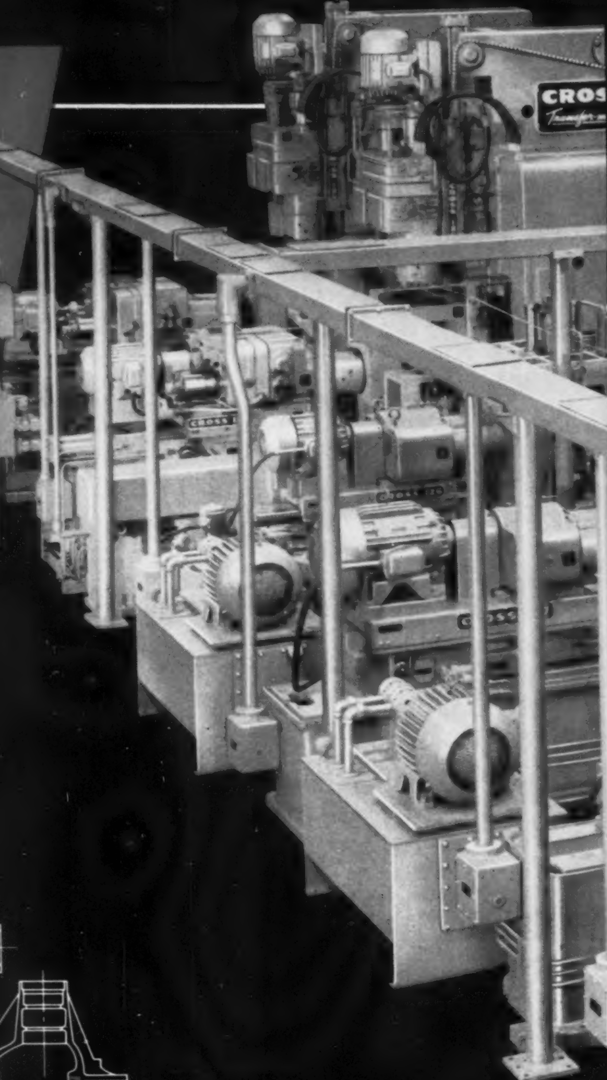
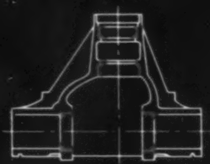
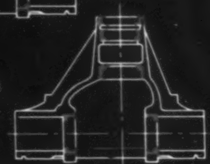
Precision Bores Axle Housings

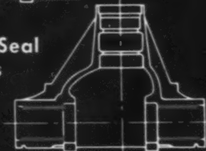




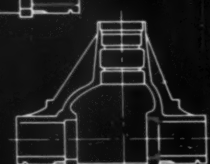
Station 11
Finish Bore
Four Bearing Seats



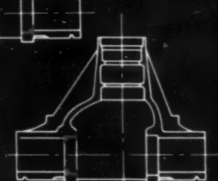
Station 9
Semi-Finish Bore Oil Seal
and Bearing Seats



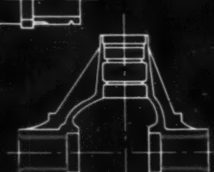
Station 7
Finish Bore
Tube Diameters



Station 5
Rough Back-bore
Right Side

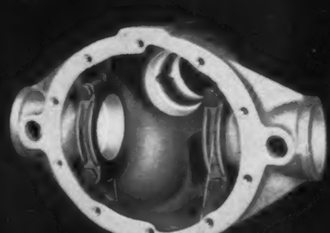


Station 4
Rough Back-bore
Left Side



Station 3
Semi-Finish Bore
Tube Diameters

Station 2
Rough Bore
Tube Diameters



Station 1
Load Two Parts

Three case histories

How 3 companies improved production by changing to

STANICUT Cutting Oils

Here are reports on three companies that have recorded (1) increases in production (2) better machine performance (3) longer tool life (4) money saved by switching to a STANICUT *Cutting Oil suited to their operations. You can get similar results.*

Standard Oil industrial lubrication specialist, Ray Wells, and Stuart Bergsma, G. A. Brevik manager, inspect carburetor needle valve. Ray recommended plant's switch to STANICUT Oil 137 BCS. He is well qualified to make such recommendations. Ray is a graduate of the Illinois Institute of Technology with a degree in engineering, and he has completed the Standard Oil Sales Engineering School. He has been an industrial lubrication specialist at Standard for six years.

G. A. Brevik Manufacturing Company uses STANICUT Oil 137 BCS

G. A. Brevik Manufacturing Company, Prescott, Michigan, is the largest producer of carburetor needle valves. The company was blending its cutting fluid from four different oils. Still they experienced tool breakage and ring formation on the surface of the stainless steel they were machining. Then one machine was converted to STANICUT Oil 137 BCS to test the oil's suitability for this operation. Soon all machines were converted.

Production increased 25% because of the improved performance of the machine tool. Cutting oil inventories have been reduced from four different oils to one. Tool life has been extended. There is no variation in fluids as there was when four oils were being blended, and there is no messy blending operation.

STANICUT Oil 137 BCS is ideally suited for severe, high speed machining.

A few of the stainless steel parts machined on automatic lathes at G. A. Brevik Manufacturing Company using STANICUT Oil 137 BCS.

STANDARD

Some of the pieces manufactured by Dearborn Centerless Grinding Co. Materials used are stainless steel, Inconel and Nichroloy.

Operator George Laverdiere and Standard Oil lubrication engineer, Leland J. Loomis, examine piece just off Cincinnati centerless grinder. Lee Loomis is another man who knows how to advise on metalworking problems. Lee has had ten years' experience in such work, has an engineering degree from Tri-State College and has graduated from the Standard Oil Company's Sales Engineering School.

Dearborn Centerless Grinding Co. uses STANICUT Oil 126 BCS

Difficult-to-grind stainless steel was the problem at Dearborn Centerless Grinding Company. Wheel loading and wheel break-down were such that soluble type oils weren't satisfactory. For this reason, Dearborn began using Stanicut Oil 126 BCS.

Company management found it secured these six important benefits by changing to Stanicut Oil 126 BCS in grinding operation:

1. Better finishes.
2. More pieces obtained per wheel dress.
3. Superior wheel life obtained on profile jobs.
4. Harder wheels could be used.
5. Finer grit wheels could be used.
6. More stock per pass could be removed.

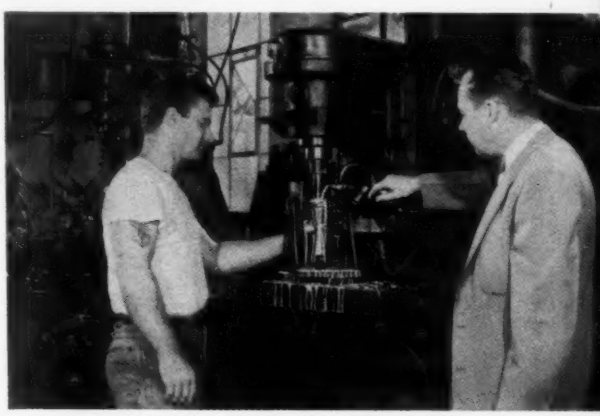
STANDARD OIL COMPANY (Indiana)

Woodford Manufacturing Company uses STANICUT Oil 155 CS

This Des Moines manufacturer was drilling and boring a steel wheel fork. Production was at the rate of 45 pieces per hour. Standard Oil lubrication specialist, Jess Nelson, called Woodford plant management's attention to the fact that Stanicut Oil 155 CS was being used successfully elsewhere in the plant. He suggested that much better production and longer tool life would be obtained if Stanicut was used in this operation.

The change, when made, increased production to 78 pieces per hour. Tool life was extended. At the same time, by using Stanicut Oil 155 CS, a 46% reduction in cutting oil costs was achieved.

Stanicut Oil 155 CS is an oil especially formulated for use in machining operations involving tough alloy steels which tend to tear and smear.



Woodford operator Elmer Light checks piece in Sundstrand Rigidmill while Standard Oil man Jess Nelson adjusts cutting oil flow. Jess, too, knows how to advise manufacturers on metalworking problems. He's had more than four years' experience doing such work. In addition, he has a degree in engineering from the University of Iowa and is a graduate of the Standard Oil Company's Sales Engineering School.

W. B. Noland, Woodford engineer, demonstrates Rollway Dock Plate to Jess Nelson. Parts machined using STANICUT Oil 155 CS are for this unit designed by Noland.

Get more data on Stanicut Cutting Oils from your Standard Oil industrial lubrication specialist. One of these men is nearby in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

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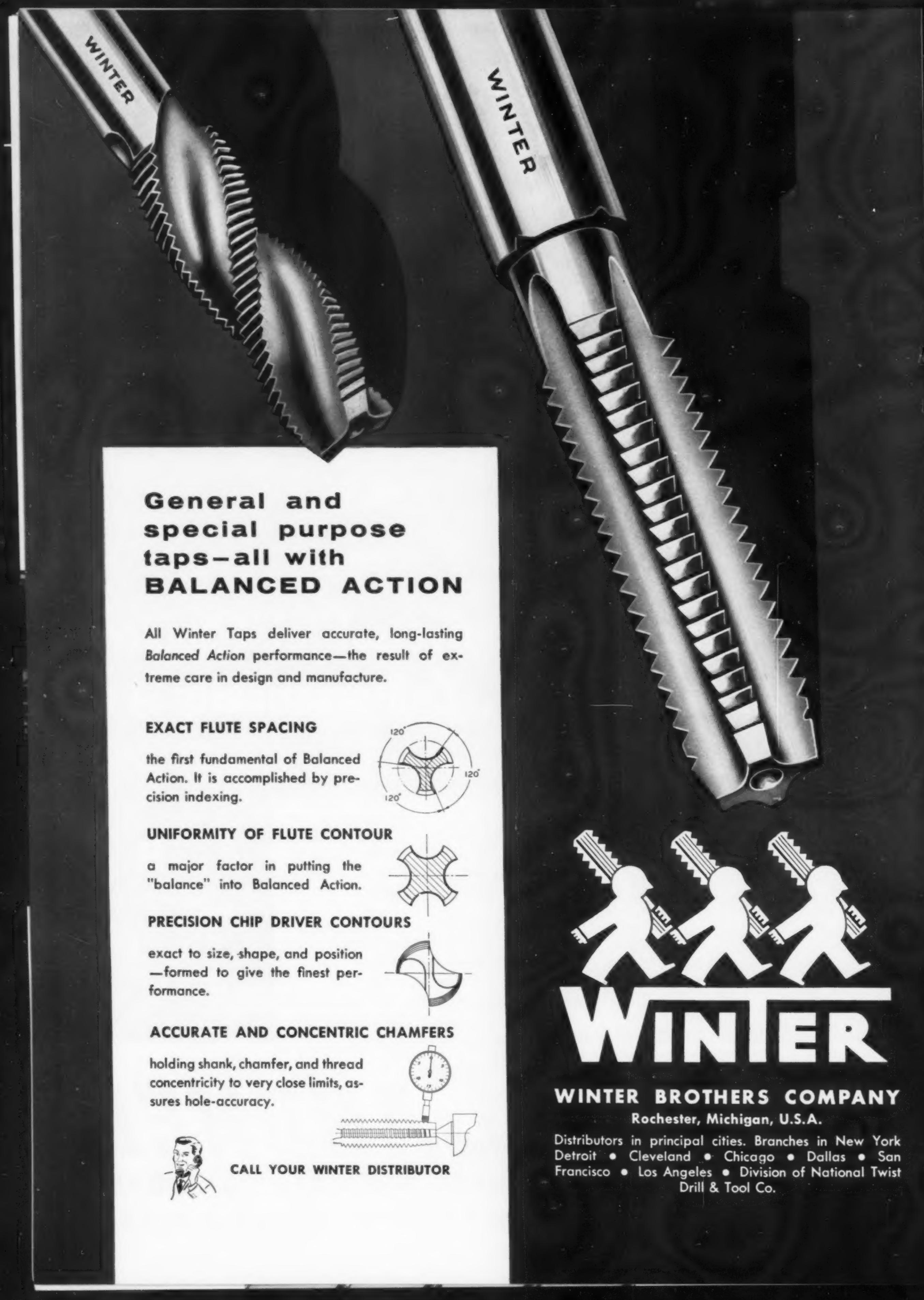
WINTER
WINTER
General and special purpose taps—all with BALANCED ACTION
All Winter Taps deliver accurate, long-lasting Balanced Action performance—the result of extreme care in design and manufacture.
EXACT FLUTE SPACING
the first fundamental of Balanced Action. It is accomplished by precision indexing.
120°
120°
120°
UNIFORMITY OF FLUTE CONTOUR
a major factor in putting the "balance" into Balanced Action.
PRECISION CHIP DRIVER CONTOURS
exact to size, shape, and position—formed to give the finest performance.
ACCURATE AND CONCENTRIC CHAMFERS
holding shank, chamfer, and thread concentricity to very close limits, assures hole-accuracy.
CALL YOUR WINTER DISTRIBUTOR
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WINTER BROTHERS COMPANY
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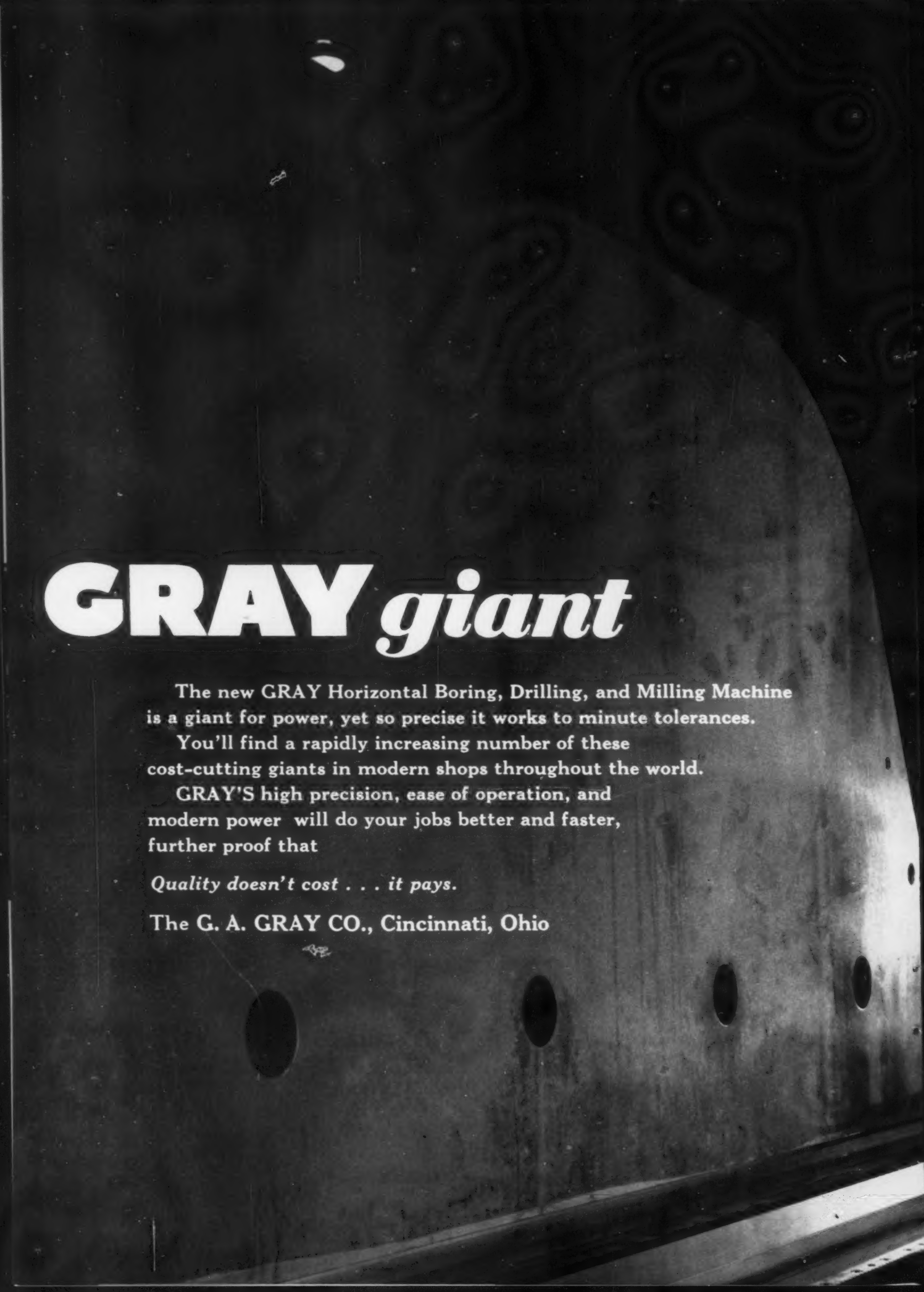
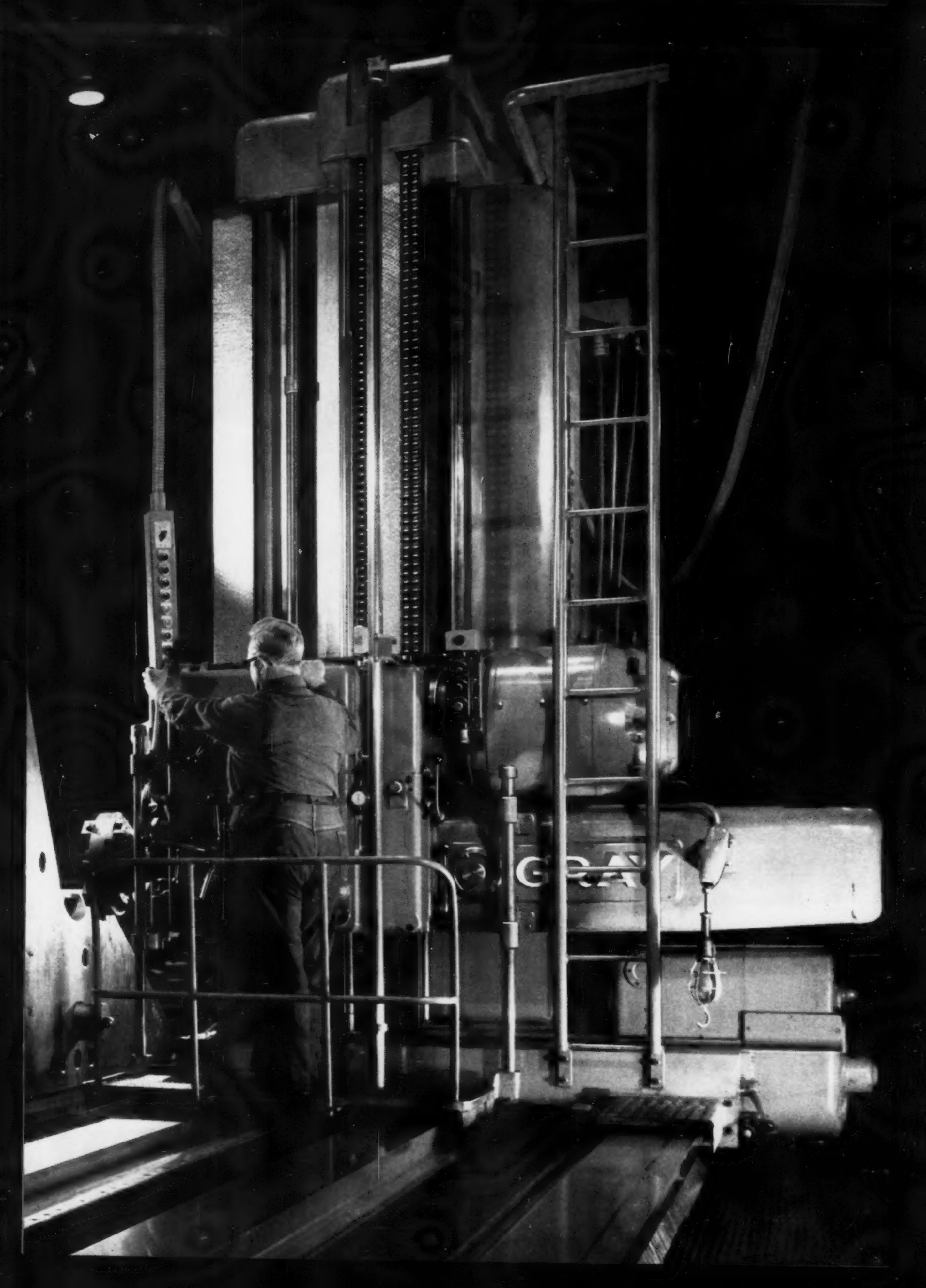
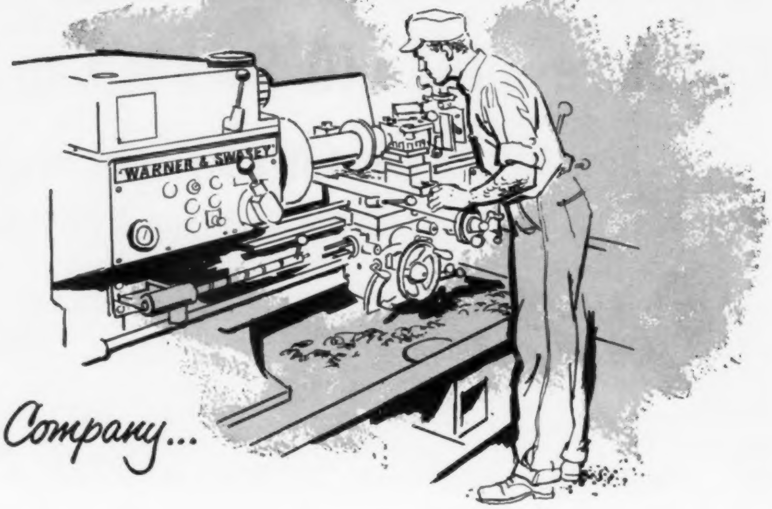

GRAY giant
The new GRAY Horizontal Boring, Drilling, and Milling Machine is a giant for power, yet so precise it works to minute tolerances.
You'll find a rapidly increasing number of these cost-cutting giants in modern shops throughout the world.
GRAY'S high precision, ease of operation, and modern power will do your jobs better and faster, further proof that
Quality doesn't cost . . . it pays.
The G. A. GRAY CO., Cincinnati, Ohio


GRAY



At Emil J. Paidar Company...

Equipment Modernization Program Pays Off

• Features New Warner & Swasey No. 4 Ram Type Turret Lathe

• Eliminates Seven Obsolete Machines • Provides $12,000 Annual Direct Labor Savings

TO KEEP PACE with today's expanding economy, progressive small shop operators are taking a closer look at their existing production facilities. Many now realize that a sound replacement policy can pay off in increased production—and profits, too. They are able to stay competitive while maintaining, or even increasing, product quality.

A case in point is Chicago's Emil J. Paidar Co. This leading producer of barber equipment installed a new Warner & Swasey No. 4 Ram Type Turret Lathe as the "keystone" of their recent modernization program. With their existing Warner & Swasey 3-A Turret Lathe, it permitted handling of all turning work on hydraulic cylinders and stems (pistons) used in Paidar barber chairs.

THE RESULTS:

- Replaced seven machines (old turret lathes, engine lathes, boring machines).
- Reduced the number of operations performed on parts because of the new turret lathe's increased accuracy and versatility over the older equipment.
- Decreased handling time on parts, because all turning is now done on two machines instead of seven.
- Increased accuracy, improved quality of the product.
- Gave increased factory space by producing more work on fewer machines, occupying less space.
- And last, but not least, in addition to indirect savings from above items, a direct labor savings of $12,000 per year has also been realized.

Why not let a Warner & Swasey Field Engineer prepare a detailed analysis of your present turning equipment now —it costs you nothing, only a phone call or letter.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

You can produce it better, faster, for less... with a Warner & Swasey

For more information fill in page number on Inquiry Card, on page 233

Now! A Complete Line of Self-Locking Microsize UNBRAKO Socket Cap and Set Screws

Nos. 0, 1, 2 and 3 in alloy steel and stainless steel are available with the Nylok* feature

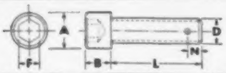
You effect major economies in time and money when you design and assemble small devices with self-locking microsize UNBRAKO socket screws. These close tolerance screws won't work loose. They simplify standardization of small devices where maximum reduction of weight is required without sacrifice of strength. They eliminate the necessity of designing costly special screws to fasten tiny parts in compact assemblies and they prevent the waste of production time while waiting for delivery of special screws.

In addition to having the overall advantages of microsize UNBRAKO socket screws, these screws can be used in holes tapped in soft or die cast materials without stripping threads and ruining expensive work. Also the set screws can be used with hardened shafts, since they lock against the threads of the tapped hole.

All UNBRAKO socket screws can be supplied with the self-locking Nylok feature. The UNBRAKO with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Seated or not, the screw locks positively wherever wrenching stops, won't work loose—because the tough resilient nylon pellet forces mating threads together.

Ask your authorized industrial distributor for details today. He carries complete stocks of self-locking UNBRAKO socket screws (caps and sets from #0 through 1 in., button heads #4 through 5/8 in., flat heads from #4 through 3/4 in.). Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.

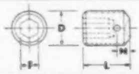
*T.M. Reg. U.S. Pat. Off., The Nylok Corporation



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO
Socket Cap Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque Max. prev. on	Torque 1st off stat. min.	Torque 5th off stat. min.
#0	A .104	—	80	1/8	—	.047	5.5	14.0*	7.0*
	B .060	—	80	3/16	—	.047	5.5	14.0*	7.0*
	D .060	—	80	1/4	—	.047	5.5	14.0*	7.0*
	F .050	—	80	3/8	—	.047	5.5	14.0*	7.0*
#1	A .118	—	72	1/8	—	.047	11.0	28.0*	14.0*
	B .073	—	72	3/16	—	.047	11.0	28.0*	14.0*
	D .073	—	72	1/4	—	.047	11.0	28.0*	14.0*
	F .050	—	72	3/8	—	.047	11.0	28.0*	14.0*
#2	A .140	56	—	3/16	.063	—	24.0	3.0	1.5
	B .086	56	—	1/4	.063	—	24.0	3.0	1.5
	D .086	56	—	3/8	.063	—	24.0	3.0	1.5
	F 1/16	56	—	1/2	.063	—	24.0	3.0	1.5
#3	A .161	48	—	3/16	.063	—	40.0	6.5	3.0
	B .099	48	—	1/4	.063	—	40.0	6.5	3.0
	D .099	48	—	3/8	.063	—	40.0	6.5	3.0
	F 5/64	48	—	1/2	.063	—	40.0	6.5	3.0

*Measured in in.-gm. (those not marked with a star are measured in in.-oz.)



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO
Socket Set Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque Max. prev. on	Torque 1st off stat. min.	Torque 5th off stat. min.
#0	D .060 F .028	—	80	3/32	—	.047	5.5	14.0*	7.0*
		—	80	1/8	—	.047	5.5	14.0*	7.0*
		—	80	5/32	—	.047	5.5	14.0*	7.0*
		—	80	3/16	—	.047	5.5	14.0*	7.0*
		—	80	1/4	—	.047	5.5	14.0*	7.0*
#1	D .073 F .035	—	72	1/8	—	.062	11.0	28.0*	14.0*
		—	72	5/32	—	.062	11.0	28.0*	14.0*
		—	72	3/16	—	.062	11.0	28.0*	14.0*
		—	72	1/4	—	.062	11.0	28.0*	14.0*
#2	D .086 F .035	56	—	1/8	.062	—	24.0	3.0	1.5
		56	—	5/32	.062	—	24.0	3.0	1.5
		56	—	3/16	.062	—	24.0	3.0	1.5
		56	—	1/4	.062	—	24.0	3.0	1.5
#3	D .099 F .050	48	—	5/32	.093	—	40.0	6.5	3.0
		48	—	3/16	.093	—	40.0	6.5	3.0
		48	—	1/4	.093	—	40.0	6.5	3.0

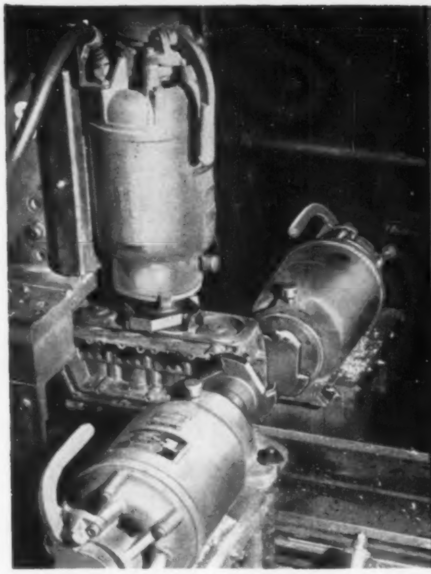
*Measured in in.-gm. (those not marked with a star are measured in in.-oz.)

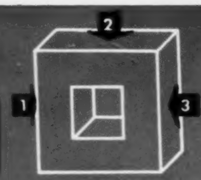
Self-locking microsize UNBRAKO socket cap and set screws are available in sizes #0 through #3, in heat treated alloy steel (plated or unplated) and stainless steel, at your authorized industrial distributor. He also carries a complete stock of other self-locking UNBRAKO socket screws.

We also manufacture precision titanium fasteners. Write for free booklet.

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co., Inc. • Cooper Precision Products • Standco Canada Ltd. Unbrako Socket Screw Co., Ltd.





MILL UP TO 3 SIDES AT ONE TIME

WITH

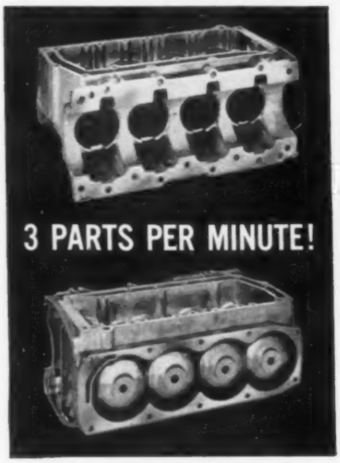
Onsrud®

A-242S

TRI-WAY MILLING MACHINE

a member of the COMPLETE family of Onsrud Milling Machines designed specifically for Aluminum and related nonferrous milling

PROOF of the tremendous productivity of Onsrud milling machines designed for nonferrous milling is shown by this production study. This kind of production is typical of the advantages that can be yours with every Onsrud milling machine.



THE PART: Outboard motor cylinder block, aluminum alloy casting 7″ wide x 13″ long and 6″ high.

THE MACHINE: Onsrud A-242S Tri-Way Milling Machine with one vertical and two horizontal opposed milling heads.

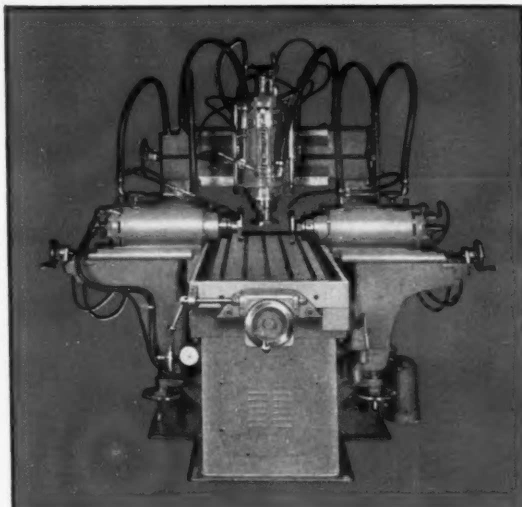
OPERATION: Machine three sides of block in on set-up and in one pass.

ACCURACY: Flatness tolerance ± 0.0003″. Parallel tolerance ± 0.001″.

PRODUCTION: Three parts per minute.

CUTTER LIFE: 500 to 1,000 parts per regrind.

Onsrud high speed milling production is only possible because Onsrud machines are designed and built specifically for milling aluminum and related nonferrous metals. The cutter speeds and feeds are exactly right to give smooth finish and precision . . . at super-high production speeds.



Onsrud A-242S Tri-Way Milling Machine, for milling up to three sides at one time, of any part square or rectangular in cross section. Planer type table with variable feed up to 258 IPM. Cutter motors Onsrud 10 HP, 3,600 RPM, liquid cooled.

Write for Information

Let us give you complete data on the Onsrud A-242S Tri-Way Milling Machine...and all other Onsrud milling machines for nonferrous metal milling. Get the facts on these proved, high speed production machines. Your inquiry is cordially invited.

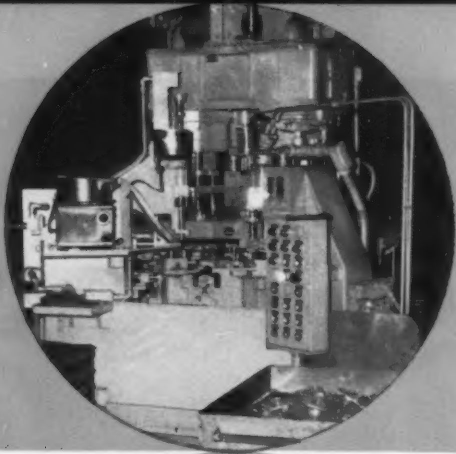
ONSRUD
MACHINE WORKS, INC.
machine tool division

7716 Lehigh Avenue
Niles 31, Illinois
(SUBURB OF CHICAGO)

Onsrud® HIGH SPEED **MILLING MACHINES** FOR ALUMINUM AND RELATED NONFERROUS METAL MILLING

For doing things *better* by doing things *differently!*

For more information fill in page number on Inquiry Card, on page 233



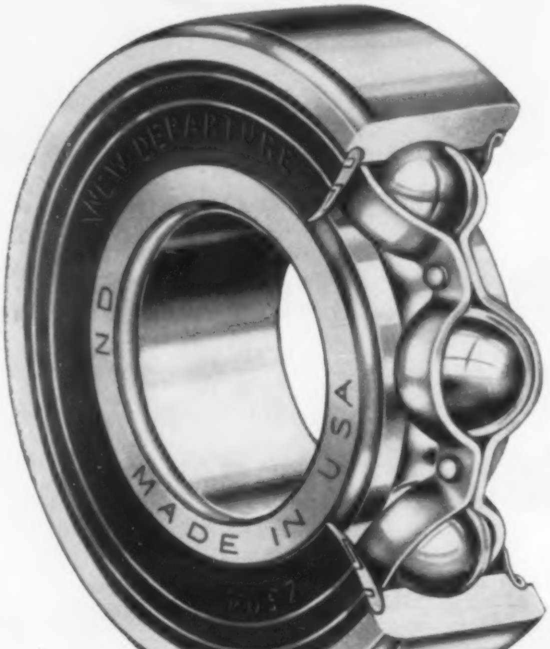
Two sizes of motor end-plates are assembled, bored, drilled and tapped in a Natco 3-Way Machine.

At Wagner Electric Corporation

One Natco

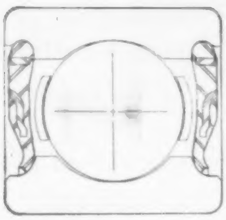
For more information fill in page number on Inquiry Card, on page 233

ND FACTS



SENTRI-SEAL

on guard against dirt and wear!



The diagram shows in section the New Departure Sentri-Seal. Lip-contacting surfaces are form-ground simultaneously with the ball race, giving an extremely high degree of concentricity between sealing surfaces and the raceway.

The unique design of the Sentri-Seal gives optimum protection against dirt, and includes a number of other major advantages.

Sentri-Seals can be removed, easily replaced. As the seal is of synthetic rubber in which two metal rings are embedded, a constant-rate spring is created between the rings. Inherent flexibility prevents distortion of the bearing outer ring due to seal insertion, permitting the use of bearings to the higher accuracy specifications. The spring action maintains an efficient sealing contact with the bearing ring to bar dirt and retain lubricant. Sentri-Seals are relatively inert to oils and greases and operate satisfactorily through a temperature range of −40°F. to 225°F. Specifications available for still higher temperatures. In applications where relubrication is desired, it is easily accomplished by the injection method.

Write for full details on Sentri-Seal

ONE SENTRI-SEAL | SEAL AND SHIELD | SEAL AND SNAP RING | TWO SEALS AND SNAP RING | SEAL, SHIELD AND SNAP RING

1908–1958 GM FORWARD FROM FIFTY

Sentri-Seal is available for a range of sizes in single-row, standard-width bearings and also in two types of New Departure adapter bearings. Sizes, dimensions and capacities are listed in the latest New Departure catalog.

NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

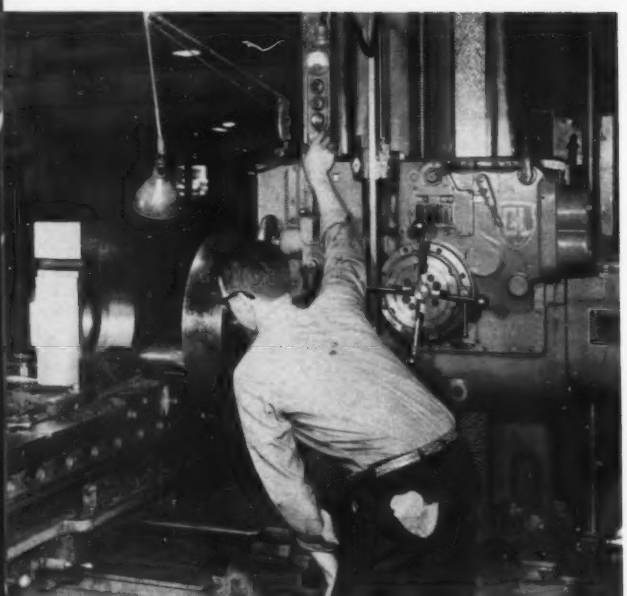
For more information fill in page number on Inquiry Card, on page 233

HOW IT'S DONE
with Giddings & Lewis

HYPRO double housing planer

At Rice Barton Corporation . . .

Plane alloy steel end frames at 300 sfm



This G & L Model 350-T (table type) Horizontal boring, drilling and milling machine is equipped with a continuous feed facing head and tungsten-carbide tool, used for rough and finish boring a $14\frac{9}{16}''$ dia. bore in an all-steel bearing housing. Rough cut at 28 rpm, .0125 rpm feed; finish cut at 46 rpm, .0175 ipr feed.

Alloy steel weldments, weighing as much as 30-tons, are planed profitably on three Giddings & Lewis HYPRO double housing planers with tungsten-carbide cutting tools at the Rice Barton Corp., Worcester, Mass.—one of America's foremost designers and builders of papermaking machinery.

Approximately 55% of all tungsten-carbide planing of the major components for a Fourdrinier papermaking machine is accomplished on the G & L 72" x 30" HYPRO double housing planer pictured above. Here, both rail heads are employed to plane a 20' $1\frac{1}{16}''$ x 15" top surface of two alloy steel side frames for a Fourdrinier. Cut taken is $\frac{1}{8}''$ deep, feed $\frac{1}{16}''$ at 300 sfm.

For complete information on Giddings & Lewis HYPRO double housing and openside planers, featuring dual rail controls for feeds and rapid traverse from either side of machine and table speeds up to 400 sfm, write for Bulletin No. 250.

Other Giddings & Lewis machines which help to produce precision parts for large papermaking machines include: two HYPRO double housing planers, two Model 350-T and three Model 340-T Horizontal boring machines, two Cincinnati Bickford Super Service Radials (17" dia. col., 5-ft. arm), and a 48" x 48" x 20' HYPRO openside planer.

G & L AND HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines and VARIAX Profile Milling Machines.

HOW IT'S DONE
with Giddings & Lewis

...6-ft. HYPRO
Vertical boring and turning mill

...MODEL 340-T
(table-type) Horizontal boring, drilling and milling machine

Precision machining butterfly valves

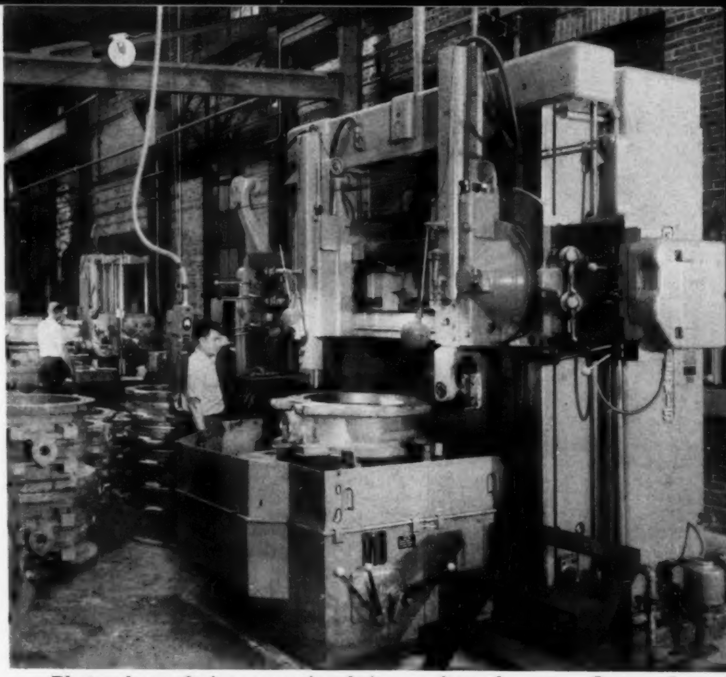
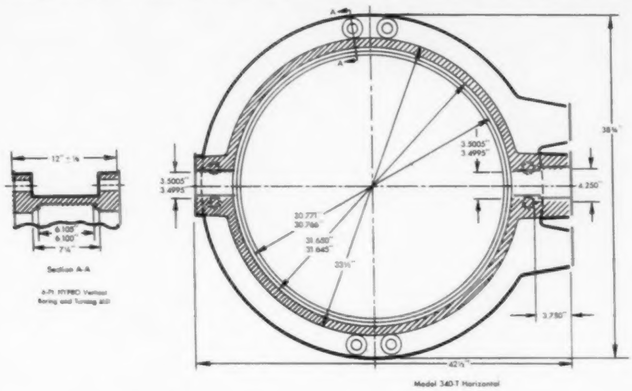


Photo shows facing operation being performed on top flange of a 30-inch, tight-closing, rubber seated, close-grain cast iron butterfly valve body on G & L's 6-ft. HYPRO Vertical boring and turning mill.

At Builders-Providence Inc., a division of B-I-F Industries Inc., Providence, R. I., these Giddings & Lewis machines are on-the-job 16 hours per day. They perform all precision boring, facing and milling operations on tight-closing, rubber seated, close-grain cast iron butterfly valve bodies ranging in diameter sizes thru 48 inches.

The 6-ft. HYPRO Vertical is used to face the flanges and precision-bore the valve seat surfaces. The versatile Model 340-T (table-type horizontal with 4″ dia. spindle) mills the mounting bosses and precision-bores the stuffing gland and valve shaft diameters—all in a single setup.

Giddings & Lewis HYPRO Vertical boring and turning mills are available with table diameters from 54″ to 12′ with motor drives up to 100 hp, and Horizontal boring, drilling and milling machines in spindle diameters from 3″ to 14″ with main motor drives from 10 to 150 hp. For complete specifications on these machines, contact your nearest Giddings & Lewis sales representative, or write direct.



Versatile Model 340-T (table-type) Horizontal is equipped with a G & L combination plain, hand and power feed 60″ rotary table which permits fast and accurate indexing of workpiece without changing setup. Rough, semi-finish and finish boring is accomplished with Davis expandable two-cutter block boring bars.

Production machining sequence:

MODEL 340-T HORIZONTAL

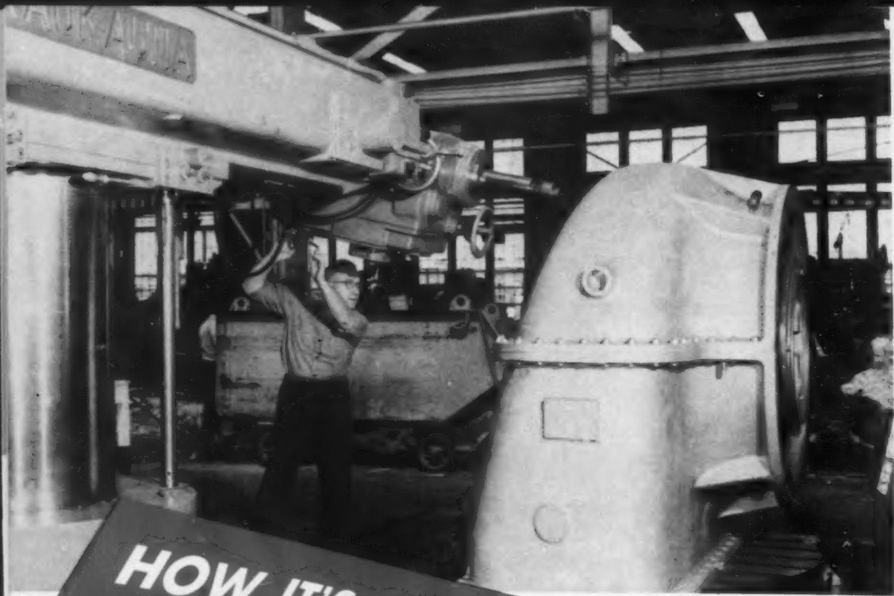
- Precision-mill four integral mounting bosses for the valve operator bracket and also stuffing gland face using an 8-inch, 10-tooth, cemented carbide face mill cutter.
- Rough, semi-finish and finish bore 4.250″ dia., 3.750″ deep stuffing gland bore; rough and finish bore 3.5005″ dia. bore within .010″ tolerance for valve shaft.

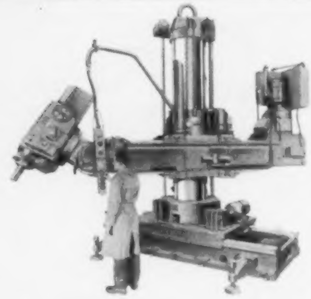
HYPRO VERTICAL BORING MILL

- Rough and finish turn top and bottom flanges . . . finish to 12″, plus or minus .125″, from top to bottom flange surface.
- Rough and finish bore inside of flanges to 30.000″ within .005″ tolerance.
- Rough and finish bore inside diameters 30.771″ and 31.650″ to 6.105″ deep within .005″ tolerance.

G & L AND HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines and VARIAX Profile Milling Machines.





Kaukauna Universal Radial drilling machines are available in 6-ft. arm, 14″ dia. column and 8′-10″ arm, 9′-10″ arm 22″ dia. column, with spindle drive motors ranging from 5-20 hp.

ONE MACHINE!
Kaukauna Model 140-U Universal Radial drilling machine.

ONE SETUP!
Angular, vertical, horizontal, compound angular drilling, tapping, boring, reaming on workpiece of ANY SHAPE . . . ANY SIZE.

HOW IT'S DONE
with Giddings & Lewis

Building turbines and motors for "power-conscious" America

At General Electric's Gas Turbine Department, Schenectady, New York, this versatile Kaukauna Model 140-U Universal Radial provides speed and precision in drilling, tapping, boring of angular and horizontal holes in gas turbine casings. Illustrated above, the Model 140-U performs angular drilling in inlet casing for a locomotive gas turbine.

The Kaukauna Universal Radial, used by General Electric, has a 4″ dia. spindle. The machine features 360° head and column swivel, 180° vertical trunnion swivel, head adjustment in and out, vertical arm traverse on column and horizontal column traverse on runway.

Other Giddings & Lewis machine tools at General Electric—Horizontals, Vertical boring mills, Super Service Radials, HYPRO double housing and openside planers—help build some of the largest and most versatile prime movers (propulsion turbines, steam turbines, gas turbines) for "power-conscious" America.

No matter what your machining requirements may be, your Giddings & Lewis sales representative can help you with your problems. For more information on the Kaukauna Model 140-U Universal Radial, write for Catalog.

KMF G&L

KAUKAUNA MACHINE & FOUNDRY DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
KAUKAUNA, WISCONSIN

Vertical Turret Lathes, Universal Radial Drilling Machines, Horizontal Drilling, Tapping and Boring Machines, Floor Type Horizontal Boring, Drilling and Milling Machines, Gray Iron Castings.

Most powerful drilling machine ever built — that's Cincinnati Bickford's Master Super Service Radial with 26″ dia. column, 12-ft. arm being used for large hole drilling of a generator end shield for a General Electric 156,000 kw generator.

This 24″ Super Service Upright drilling machine with 4″ dia. jig boring spindle and compound table is used for precision boring of auxiliary arm for universal flame cutting machine. Boring held to .0001″ limits. The Cincinnati Bickford Upright is in tool room of G-E's Large Motor and Generator Department.

HOW IT'S DONE
with Giddings & Lewis

Davis standard tooling on G & L Model 340-T

- **Floor-to-floor time cut from 22½ to 7 hours 26 min.**
- **Workpiece setups reduced from 7 to 3**
- **G & L Horizontal with Davis tools performs precision operations formerly done on 5 different machines**

For complete specifications on the Davis line of standard and special tooling, write for Catalog No. 304.

JOHNSON & BASSETT Inc., Worcester, Mass., reports:
"considerable savings in machining indexing trunnions"

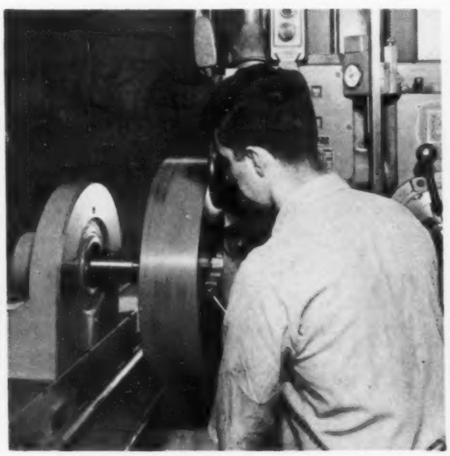
Pictured at work is a Giddings & Lewis Model 340-T (table-type) Horizontal with 4" dia. spindle and completely equipped with *Davis standard cutting tools.* Before Johnson & Bassett installed the Model 340-T with Davis tooling all drilling, milling, facing, turning and boring operations on 18" indexing trunnion bases were performed on five different machines, requiring 22½ hrs. floor-to-floor time. Now, virtually all of the machining is accomplished on the Model 340-T with Davis standard cutting tools — tungsten-carbide and high-speed — in three instead of seven setups. Floor-to-floor time is 7 hours 26 minutes.

Davis tooling includes: two-cutter blocks with expandable diametrically opposed cutters for boring—ranging from ¾" thru 17". Davis super micrometer-adjustable stub boring tool set, consisting of different length stub boring bars; offset boring head and facing head, plus a complete assortment of accessories for the boring head and bars.

Whether you need standard or specially engineered tools, be sure to contact your local Davis sales representative.

DAVIS BORING TOOL DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Line and Stub Boring Bars, Boring Heads, Block Type Cutters, Planing and Turning Tools, and Special Production-Engineered Job Tooling.

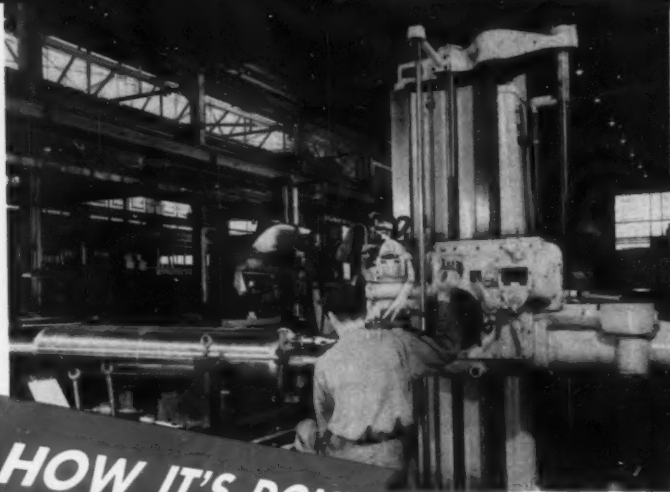


MILLING—Base of indexing trunnion rough and finish milled with 8" dia. tungsten-carbide face mill at 150 rpm, 13" feed. The 18" dia. face is rough and finish turned with 24" G & L continuous feed facing head, using Davis tool bits, at 60 rpm .025 ipr feed.

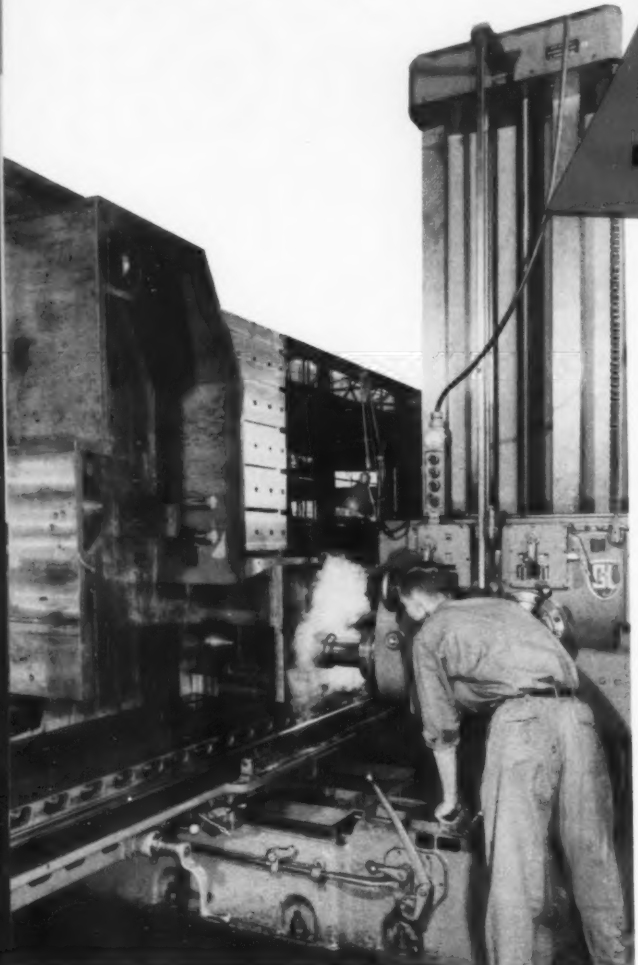
BORING—The 5" dia. by 8" long hole is rough and finish bored with Davis Super micrometer stub boring bar with tungsten-carbide tipped tool bits at 190 rpm, .005" ipr feed. Two 1-inch holes are drilled, bored and reamed.

BACK FACING—The end of 7" dia. hole is back faced using a Davis telescopic tool holder with tungsten-carbide tipped cutter.

MODEL 330-T HORIZONTAL—Ten holes in each end of this steel blanket cylinder for a 10-color offset printing press are precision drilled, reamed and tapped on the G & L Model 330-T (table-type) Horizontal boring, drilling and milling machine. All holes are tapped at 108 rpm.



MODEL 350-T HORIZONTAL—This 70″ x 78″ long all-steel end frame for a 10-color offset printing press is precision bored, drilled, milled, reamed on G & L Model 350-T Horizontal. Machine is shown finish boring a 9″ dia., 3½″ deep bore with a Davis tungsten-carbide tipped cutter.



HOW IT'S DONE
with Giddings & Lewis

precision boring steel end frames for color offset printing presses

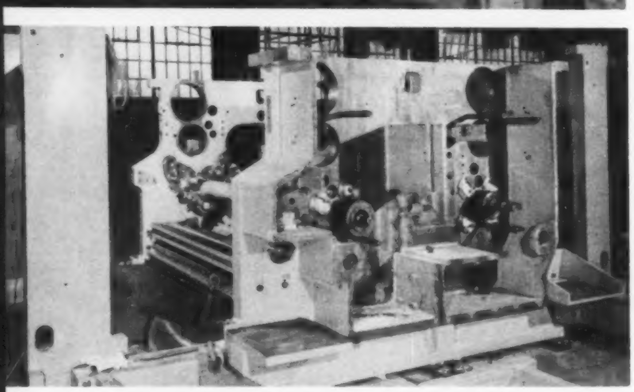
Dependable horizontals assure product quality

Versatility and ease of operation, precision boring within .0002″—important reasons why three G & L Horizontal boring, drilling and milling machines are always on the job at Frederick H. Levey Co., Inc., Machinery Division, Philadelphia, Pa. Practically 90% of all precision machining, required on press frame steel castings for offset color printing presses, are performed on two Model 350-T's and one Model 330-T Horizontals.

Here's typical production sequence in precision boring, drilling, milling, reaming and tapping operations performed on steel end frame on Model 350-T Horizontal.

1. Both ends of frame milled to 21½″ width with a 12″ dia. carboloy face-mill cutter.
2. Inside of frame rough and finish milled within plus or minus .0002″.
3. A series of 1″ dia. shoulder bolt holes drilled and reamed.
4. Rough and finish boring operations performed in single setup, using Davis boring tools, are as follows: one 14½″ dia. cylinder for, plus .0008″ and minus .0000″; 11¾″ bore, plus .0008″ and minus .0000″; four 4.330″ dia. bores; one 5.000″ dia., one 4.724″ dia. locating bore, and three 1⅝″ diagonal bores.
5. Approximately 100 additional holes from ⅜″ to 1″ dia. are drilled and tapped.

For complete specifications on the Model 350-T Horizontal, contact your Giddings & Lewis representative. Write for Catalog No. 30-T.



Right and left all-steel end frames completely machined on G & L Horizontal boring, drilling and milling machines are shown on assembly floor. When assembled, unit will be one section of a 10-color offset printing press.

G & L AND HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

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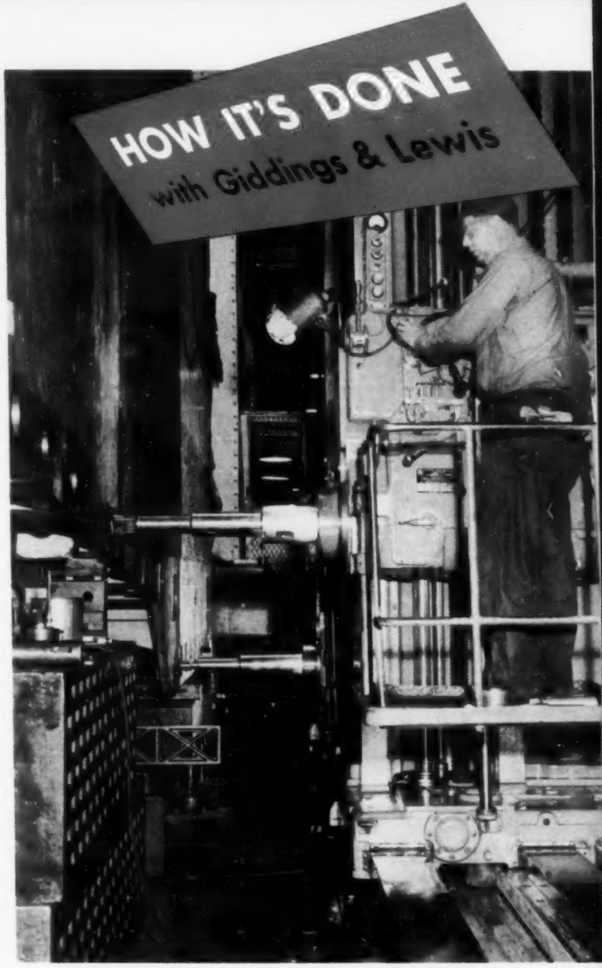
Building supersonic wind tunnels, aircraft carriers, luxury liners, hydro and steam turbines at Newport News Shipbuilding and Dry Dock Co.



Two Model 360-F Horizontals on 60-ft. runway boost production machining 98%

Two Giddings & Lewis floor-type Horizontals, each with 30-ft. runways in line, perform all boring, drilling, reaming and spotfacing operations on a 63-ton, 178″ x 455.453″ long, *No. 410 stainless steel* side-wall for a supersonic wind tunnel. This dual machine arrangement increased production by 98%.

At Newport News Shipbuilding and Dry Dock Company's 225 acres of plant facilities, 20 Giddings & Lewis machines—6 Super Service Radials, 6 Horizontals (table and floor types), 6 HYPRO double housing and openside planers, one 12-ft. Vertical boring mill—daily perform precision operations on large castings and steel weldments for aircraft carriers, oil tankers, luxury liners, etc.

For more information and complete specifications on 30 Series floor-type Horizontals, see your Giddings & Lewis representative. Ask for Catalog No. 30-F.

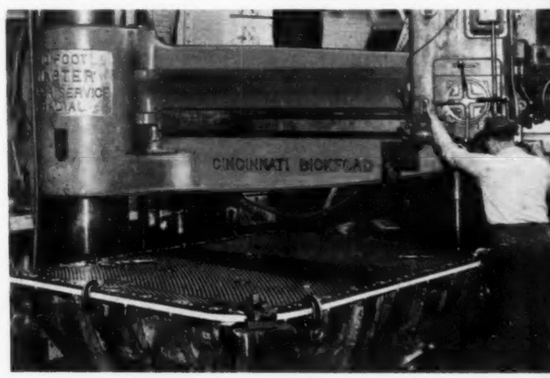
Here's sequence of machining operations performed in two set-ups:

1. Twenty-eight 4.000″ dia. holes rough and finish bored, at 43 rpm, .010 ipr and reamed with high-speed tool at 10.5 rpm, .005 ipr.
2. Fourteen 4.125″ dia. holes, 12″ deep, rough and finish bored at 43 rpm, .010 ipr. All holes spotfaced to 9″ dia.
3. Six 6.125″ dia. x 40″ deep holes rough and finish bored, and spotfaced. Finish boring done with high-speed floating cutter at 8.3 rpm, .125 ipr.
4. Two 3.125″ dia. holes, 40″ deep, rough and finish bored and then reamed. Finish bored at 34 rpm, .031 ipr.
5. One 35.030″ dia. window opening rough and finish bored at 8.3 rpm, .010 ipr, using G & L's continuous feed facing head equipped with a high-speed cutter.

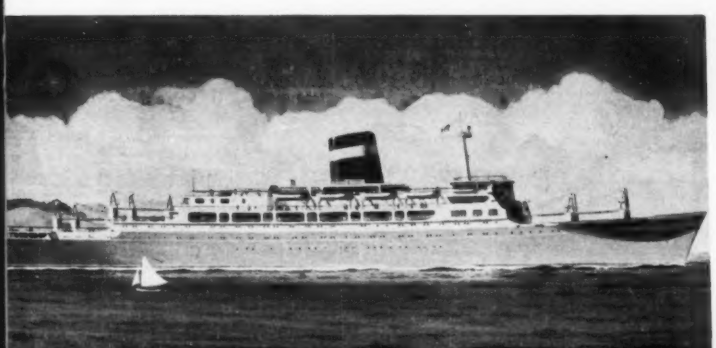
G & L AND HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

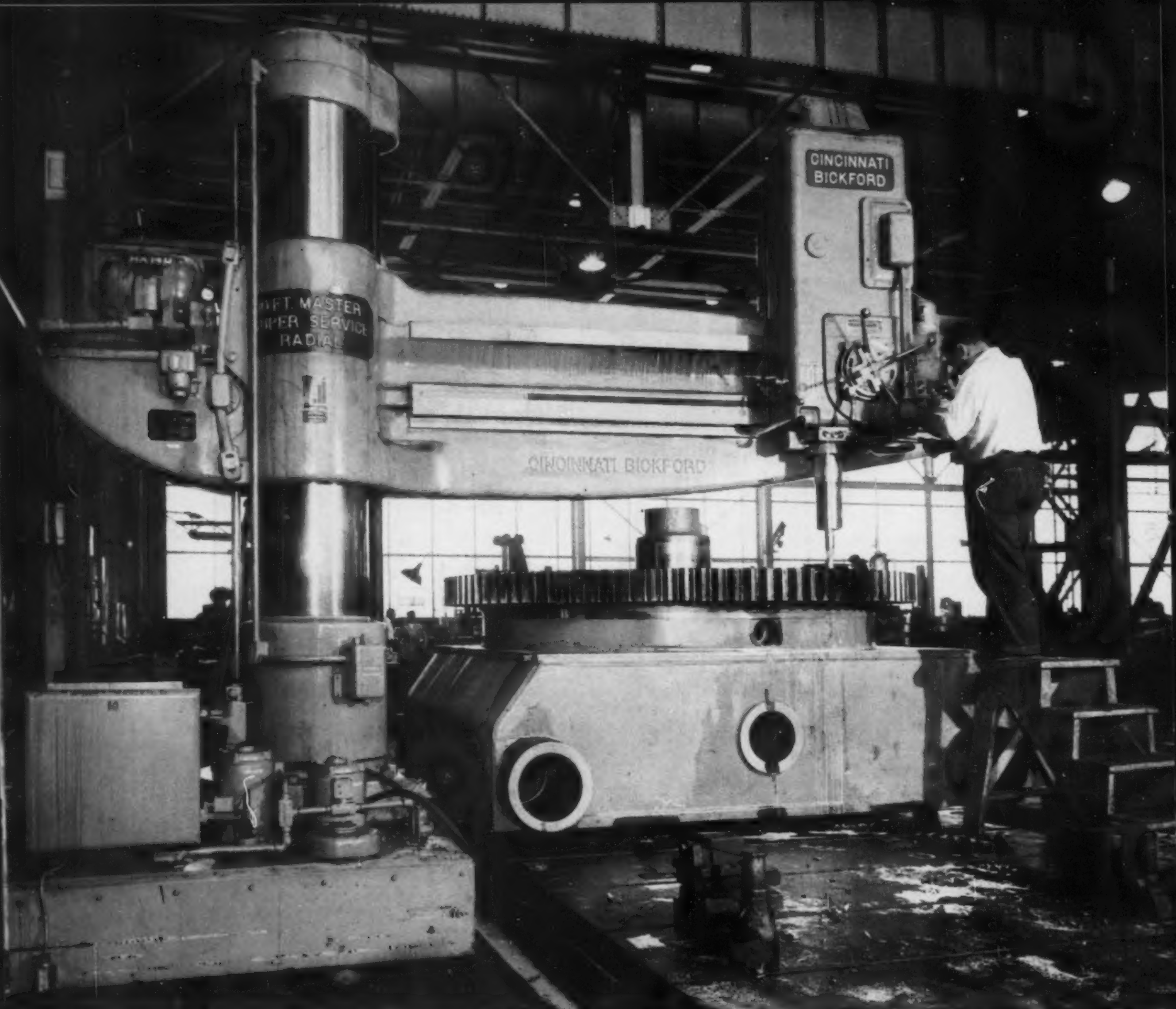
HYPRO

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines and VARIAX Profile Milling Machines.

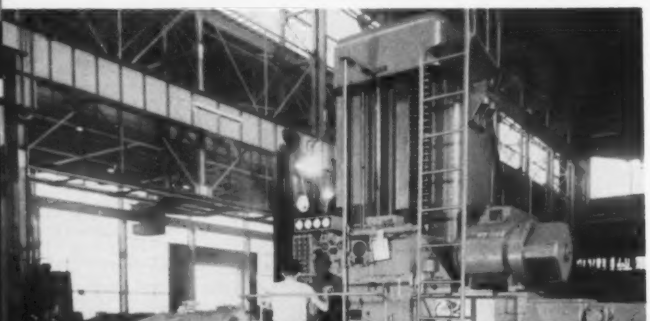


This Master Super Service Radial, 26″ dia. column and 10-ft. arm, precision drills (66) 15/16″ and (34) 1 3/16″ dia. holes and taps (8) 3/4″ holes in the chrome-nickel main condenser head for one of two twin-screw, 300 passenger liners (shown at left) being built for Grace Lines. New ships will replace the "Santa Rosa" and "Santa Paula" in Caribbean service.





AT NEW YORK SHIPBUILDING CORP.—All drilling, reaming and tapping operations on this 20,295-lb. all-steel lower frame assembly with ring gear for a 4½ cu. yd. drag line are performed by a Cincinnati Bickford Master Super Service Radial (22″ dia. column, 10-ft. arm) with track type base, traveling on rails 60-ft. long.



MODEL 570-FUAR HORIZONTAL EQUIPPED WITH DAVIS BORING BARS AND CUTTING TOOLS

This versatile Model 570-FUAR Horizontal boring, drilling and milling machine with 7″ dia. spindle and built-in underarm support is equipped with a full complement of Davis bars, tungsten-carbide and high-speed cutters in various sizes.

A rotary table with motor drive independent of machine permits multiple setups—floor-to-floor time reduced by 50%.

Machining operations performed on steel weldment for a large shovel are:

1. One 11.046″ axle bore roughed and finished within .0015″ tolerance.
2. One 10.030″ idler bore roughed and finished within .0015″.
3. A 7.254″ and 8.004″ dia. bore roughed and finished within .003″ tolerance. Both bores, one on each side, are counterbored within .001″.

HOW IT'S DONE *with Giddings & Lewis*

When New York Shipbuilding Corporation, long known as the "builders of the finest ships afloat," diversified their operation to include the manufacture of power shovels and drag lines, they selected the . . .

TOP PERFORMER--Cincinnati Bickford Master Super Service Radial with track type base

Convenient centralized controls, low on the head . . . wide range of speeds and feeds . . . easy-to-swing arm—all provide for greater production in machining a $5\frac{1}{4}$-ton, all-steel frame assembly for $4\frac{1}{2}$ cu. yd. shovel. Pictured at left, all precision drilling, boring, reaming and tapping operations on lower frame assembly with ring gear are performed on Cincinnati Bickford's Master Super Service Radial (22" diameter column, 10-ft. arm) with sturdy track type base.

Parallel to the floor plate, 60-ft. long rails permit machining of workpieces up to 50 feet in length. This arrangement also permits multiple setup of similar workpieces, resulting in considerable reduction in floor-to-floor time.

At left, the Master Super Service Radial is shown on the job—drilling, reaming and tapping more than 75 holes of various sizes in the all-steel lower frame assembly.

Here's the production sequence:

1. Thirty $2\frac{1}{16}''$ holes, 5" deep, drilled at 190 rpm, .010 ipr feed.
2. Two 2" dowel holes drilled and reamed. Reaming operation done at 85 rpm, .024 ipr feed . . . plus or minus .004" tolerance.
3. Two $\frac{9}{16}''$ holes drilled.
4. Six $1\frac{5}{16}''$ holes drilled and tapped.
5. On top side of frame assembly—twenty-eight $2\frac{1}{16}''$ . . . six $1\frac{1}{4}''$ . . . two $1\frac{5}{16}''$ holes drilled.

Get all the facts on Master Super Service Radial drilling machines with or without track type base from your nearest Cincinnati Bickford machine tool representative.

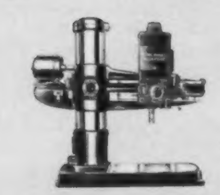
NEW Super Service Radial Catalog!

Write for new 3-color, 36-page descriptive catalog featuring Super Service Radial drilling machines with complete hydraulic pre-selection of all speeds and feeds, speeds only, or with manually-operated lever-shift controls.

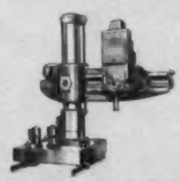
CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
CINCINNATI, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Gang Drills and Precision Production Drilling Machines designed for use with spacing table.

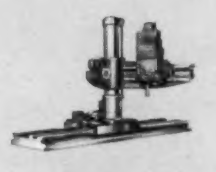
Complete Line of CINCINNATI BICKFORD Drilling Machines Available



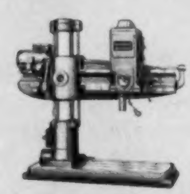
NEW SUPER SERVICE RADIAL DRILLS with complete hydraulic pre-selection of all 36 speeds and 18 feeds. Sizes: 13" column, 4' arm to 19" column, 8' arm.



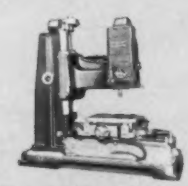
MASTER SUPER SERVICE RADIAL DRILLS—available with 40 hp motors, sizes up to 26" column and 12' arms. All types of bases including track type are available.



SLIDING-BASE SUPER SERVICE RADIAL DRILLS—designed for high production, minimized setup time. All controls centralized on head. In complete size range with 3' to 12' arms.



HIGH-SPEED SUPER SERVICE RADIAL DRILLS—choice of 6 spindle speed ranges, from 3500 rpm down to 60 rpm with 3 hp motor. Available with 3' and 4' arms.



SUPER SERVICE PRECISION DRILLING MACHINE—specially suited to operations with automatic spacing table. For precision production work, jigs can be eliminated.

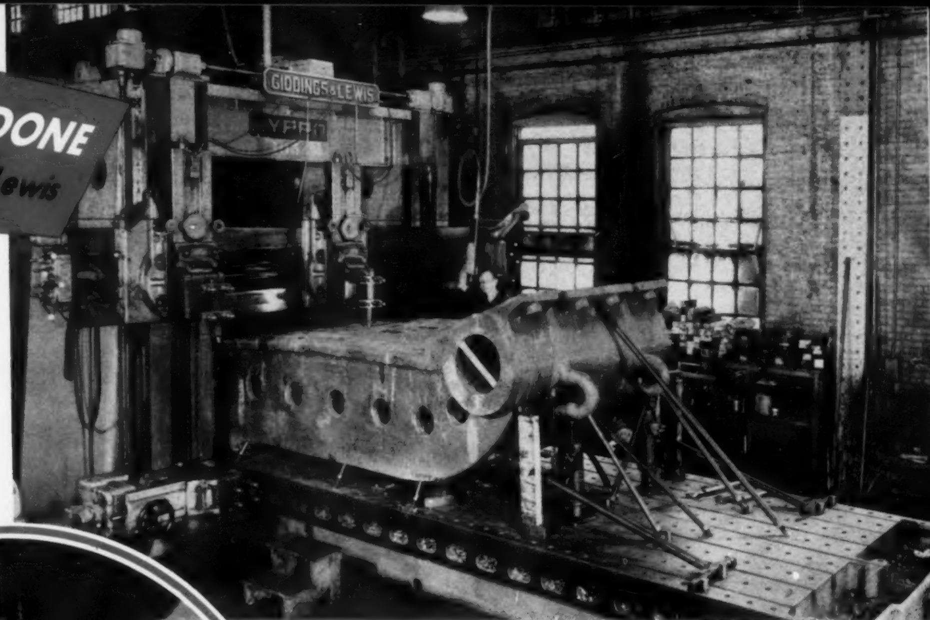
ALL-GEARED ROUND COLUMN UPRIGHT DRILLS in three sizes (21", 24" and 28") with 9 to 12 speeds.

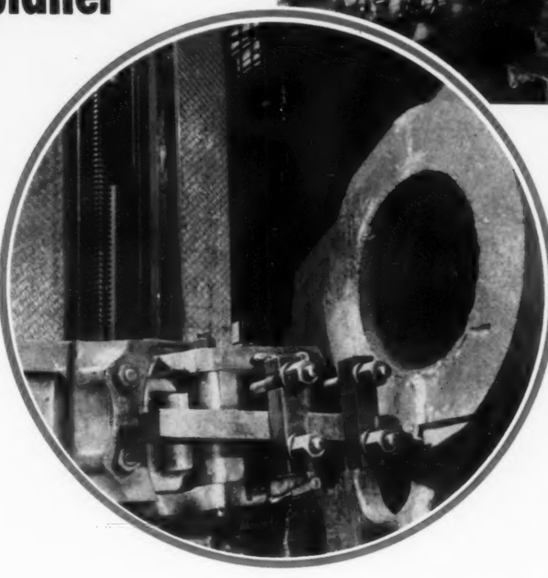
ALL-GEARED BOX COLUMN UPRIGHT DRILLS—24" unit with 5 hp motor, 28" and 39" with 5 or $7\frac{1}{2}$ hp.

SUPER SERVICE BOX COLUMN GANG DRILLS have entire mechanism in upper section. Each spindle is individually driven, saving time on successive operations.

HOW IT'S DONE
with Giddings & Lewis

HYPRO double housing planer





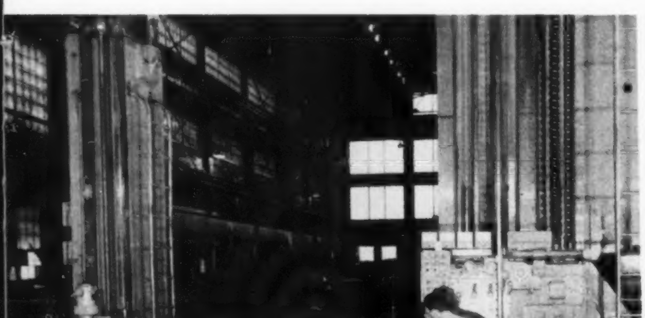
"Increase production on large workpieces by 30%... maintain precision tolerances with high-speed and tungsten-carbide tools,"
says Assistant Works Manager, P. A. Bohlander, Birdsboro Steel Foundry and Machine Co.

This 96" HYPRO double housing planer features dual rail controls, high-speed power rapid traverse to all four heads, extra-depth one-piece rail—providing utmost rigidity and ease of operation in planing large castings. According to Asst. Works Manager P. A. Bohlander, this machine increased production on large castings by 30%. Precision accuracy with either high-speed or tungsten-carbide planing tools is constantly maintained.

Photo above demonstrates tungsten-carbide planing at 200 sfm on an all-steel swing jaw, weighing 38-tons. Both side heads, used simultaneously, rough and finish plane the bearing faces. Depth of cut is shown in closeup view.

For complete specifications on HYPRO double housing planers, see your nearest Giddings & Lewis representative. Write for Bulletin No. 250.

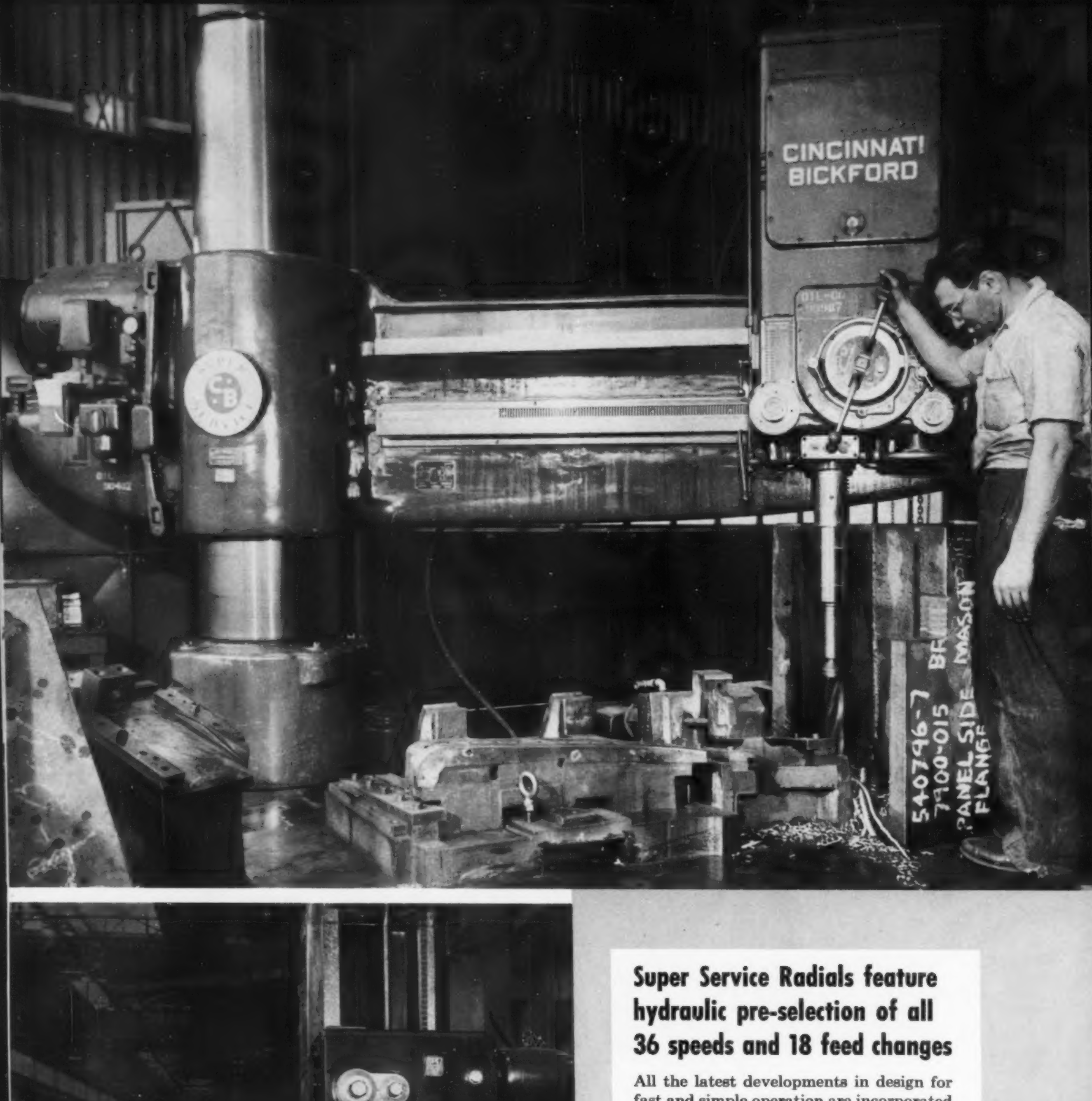
Birdsboro's steel mill machinery, crushing machines, steel castings, hydraulic presses, steel, alloy iron and alloy steel flow to all parts of the world. Playing an important production role at the Birdsboro and Reading, Pa. plants are eight G & L machines; three HYPRO double housing planers, Model 570-FUAR (floor-type) Horizontal boring, drilling and milling machine, and four Cincinnati Bickford Super Service Radials.



G & L AND HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines and VARIAX Profile Milling Machines.

The 15¼" dia., 4' 11 15/16" long bearing in steel swing jaw for crusher is rough bored at 30 rpm, .031 ipr, and finish bored at 50 rpm, .031 ipr to .002" tolerance with tungsten-carbide block-type cutter. Line boring is performed on G & L Model 570-FUAR (floor-type) Horizontal with 7" dia. spindle and underarm spindle support.



This Kaukauna Model 3040 Horizontal (4" dia. spindle) with a specially-designed 12-ft. square table, is precision boring a 3" dia. clearance hole for a cylinder rod in a quarter panel die. Finish bored at 75 rpm, .010 ipr feed, and counterbored to 4½".

Super Service Radials feature hydraulic pre-selection of all 36 speeds and 18 feed changes

All the latest developments in design for fast and simple operation are incorporated in Cincinnati Bickford's Super Service Radials with complete pre-selection of all speeds and feeds. Two easy-to-operate pre-selector dials, positioned low and logically located on each side of the head, hydraulically pre-select all 36 spindle speeds and 18 feeds—instantly and noiselessly. Pre-selecting speeds and feeds for the next operation is easily accomplished while machine is under cut. Operator simply selects the proper speed and feed while the spindle is running in either forward or reverse, or when spindle is stopped. A pre-scheduling chart, above the speed selector dial, indicates proper sequence of succeeding operations and the correct speed and feed for each.

HOW IT'S DONE
with Giddings & Lewis

At The Budd Company, Philadelphia, Pa.
production drilling, boring and tapping of automotive dies with Cincinnati Bickford
SUPER SERVICE RADIAL

Hydraulically pre-select proper speeds and feeds while spindle is running, or stopped

In operation practically 20 hours a day, six days per week—this Super Service Radial with complete hydraulic pre-selection of all 36 speed and 18 feeds is one of 12 Cincinnati Bickford machines which help to increase production drilling, boring and tapping of automobile dies at The Budd Co.

Pictured at left, the Super Service Radial with 19" dia. column, 8-ft. arm precision-drills a 3" dia. hole in a cast iron alloy (250 Brinell) upper die unit for production of quarter panels for the French car "Simca."

A company official stated that the Super Service Radial is fast and easy-to-operate, because all controls are centrally-located at the head, reducing operator fatigue considerably.

Outstanding design features, which provide for *fast, accurate* and *safe* operation, include: powerful clamping of head, column and arm; effortless, easy-to-swing arm; easy-to-read preselector speed and feed dials, positioned low and one on each side of head; rigidly supported spindle—head bearing over 17" long; dual prefocused work lights.

For complete specifications on Super Service Radials with complete pre-selection of all spindle speeds and power feeds, contact your nearest Cincinnati Bickford representative.

Other Giddings & Lewis machines in service are two Kaukauna Model 3040 (4" dia. spindle) Horizontal drilling and boring machines, and one Model 1030 (3" dia. spindle) Tilting head horizontal drilling and tapping machine, and several floor-type Horizontals.

NEW Super Service Radial Catalog!

Write for new 3-color, 36-page descriptive Catalog R-35, featuring Super Service Radial drilling machines with complete hydraulic pre-selection of all speeds and feeds, speeds only, or with manually-operated lever-shift controls.

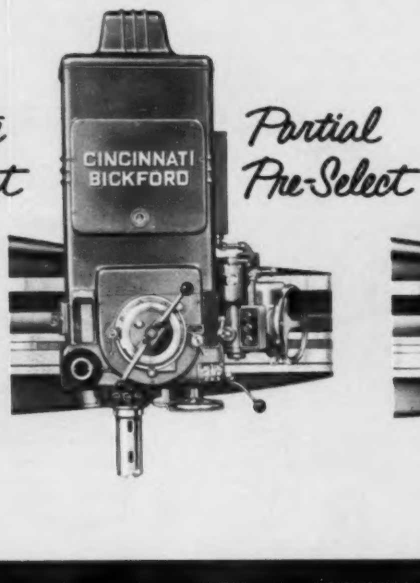
CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
CINCINNATI, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Layout Drilling Machines, Gang Drills and Precision Production Drilling Machines designed for use with spacing table.

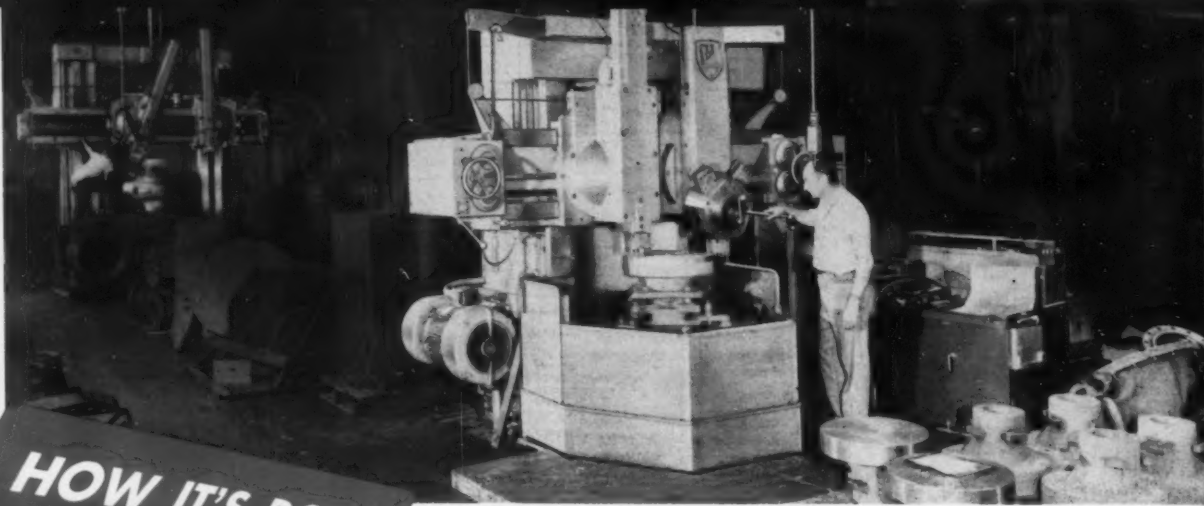
Choice of 3 separate head designs available...

Complete hydraulic pre-selection of all 36 speeds and 18 feeds

Speed pre-selection controls 36 speeds only; 18 manually-operated power feeds



Lever shift manual control of all 36 speeds and 18 feeds



HOW IT'S DONE *with Giddings & Lewis*

...42" Vertical Turret Lathe

machining steel valves at The Chapman Valve Mfg. Co.

This Indian Orchard, Mass. company gets 30% greater production of pre-heated C5 alloy steel inlet valve nozzles with the G & L 42" Vertical Turret Lathe. Both ram and 5-station turret head with tungsten-carbide tools are used simultaneously for the turning and facing operations in a single setup.

Greater productivity is obtained by the machine's ability to change feed rate of any head at any time—even while table is rotating and feed is engaged for cutting. And, speed changes are made while table is rotating and head is "in-the-cut." What's more, the ram, 5-station turret and side heads each feature independent feed and rapid traverse tool control in any combination of directions, resulting in greater efficiency, higher precision and maximum safety for the operator.

Here's the production machining sequence performed in one setup with tungsten-carbide cutting tools:

1. Rough and finish face top of nozzle with ram head, and simultaneously rough and finish turn with turret head the 22" outside diameter to 185 micro finish at 210 sfm, .020" feed.
2. Rough and finish .125" deep gasket groove to 63 micro finish, using turret head.
3. Chamfer top edge of nozzle to 45°.
4. Rough and finish underside of top flange, using turret head.

During the past four years, Chapman Valve put into service seven new Giddings & Lewis machines—6-ft., 7-ft., and 12-ft. HYPRO Vertical boring mills; Model 350-T Horizontal; two 48" x 42" x 10' HYPRO double housing planers and a 42" Vertical Turret Lathe. Other G & L machines include four Cincinnati Bickford Super Service Radials with 5, 6 and 8-ft. arms.

For complete specifications, outstanding construction and operating features of standard 32", 42" and 52" Vertical Turret Lathes, with tracer and numerical control systems, contact your Giddings & Lewis representative.

KAUKAUNA MACHINE & FOUNDRY DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
KAUKAUNA, WISCONSIN

Vertical Turret Lathes, Universal Radial Drilling Machines, Horizontal Drilling, Tapping and Boring Machines, Floor Type Horizontal Boring, Drilling and Milling Machines, Gray Iron Castings.

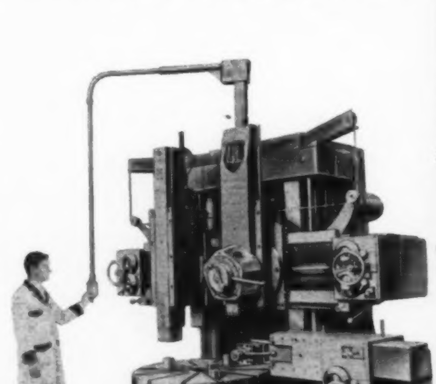
Advanced features assure greater accuracy, longer life, higher production.

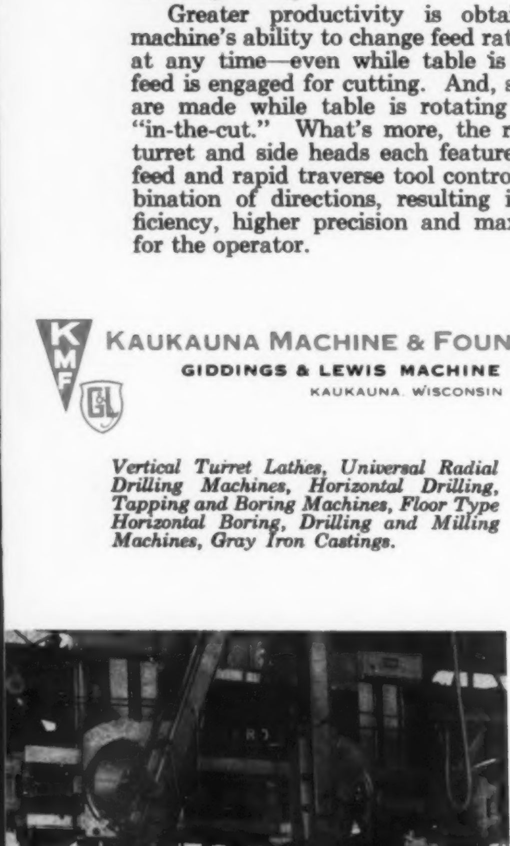
Each head has independent feed and rapid traverse tool control, individually or in any combination of directions by moving a single "Joy Stick."

Side head of rigid ram and saddle construction maintains accuracy in heaviest cuts Same "Joy Stick" control as rail heads.

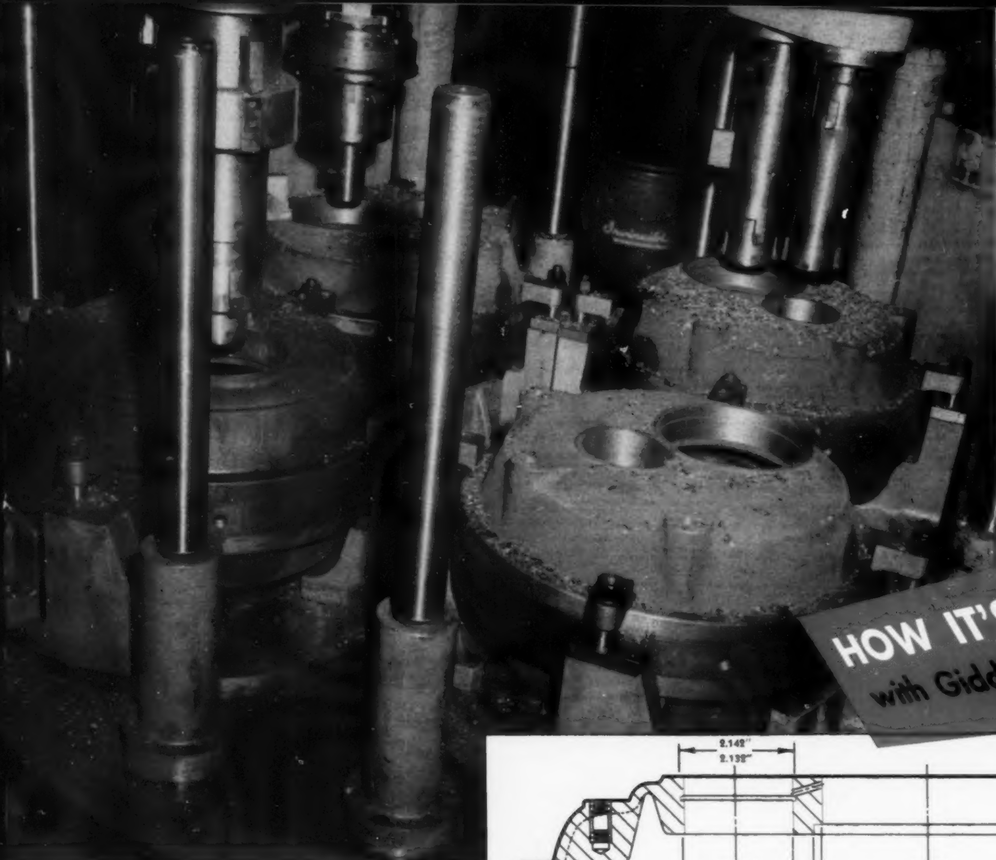
Ram and turret heads swivel 30° either side of vertical and are easily adjustable within one minute of arc by microdials mounted on each head.

Exclusive electric-clutch controlled coaxial planetary transmission permits speed changes while table is rotating, and any head is in its cut. This revolutionary design permits incorporation of a-c constant surface speed attachment as optional feature.





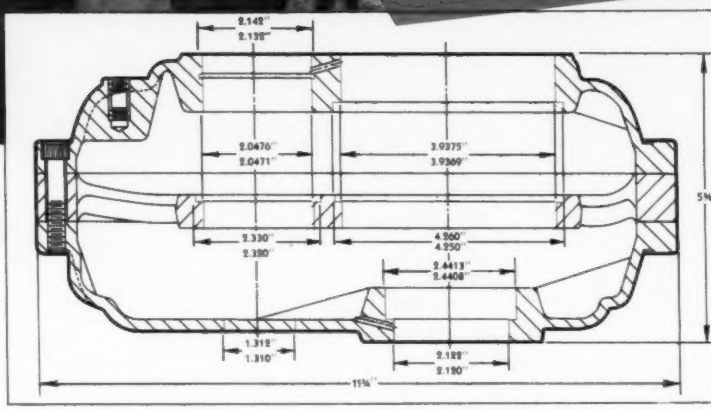
Giddings & Lewis 7-ft. HYPRO Vertical boring and turning mill is used for turning and facing operations on this cast alloy-steel valve body. Valve is destined for use on controlled circulating boiler lines operating at 2750 psi.



HOW IT'S DONE
with Giddings & Lewis

This four-station, 3-spindle indexing machine is equipped with Davis block-type cutters, used in production boring operations on speed reducer units at the American Pulley Co., Philadelphia, Pa.

Line drawing shows various bore diameters of a speed reducer unit which is precision-machined to exact tolerances with Davis block-type cutting tools.



AT AMERICAN PULLEY--Davis tooling boosts production from 4 to 21 units per hr.

At the American Pulley Co., Philadelphia, Pa. this four-station, 3-spindle rotary indexing machine, completely equipped with Davis block-type boring tools, performs a series of operations in a single pass on cast iron speed reducer housings. Multiple-cut boring operations, shown on line drawing, require finish tolerances from .0005" to .0012" for eight different diameter bores. With the Davis cutters there's no stopping of machine to check each workpiece as it is finished, or to adjust the cutting tools during production run. As a result, production increased from 4.3 to 21 units per hour.

Previously, the same boring operations were performed on another machine with special indexing fixture and multiple boring bars with single point cutters.

Davis block type cutters of various sizes, mounted on a single stub boring bar, virtually eliminated down-time. Former method required considerable time for changing cutting tools.

Whatever your production tooling problem, be sure to contact your nearest Giddings & Lewis tool specialist.

Davis offers a complete line of standard blocks, boring heads, bars and tool sets, and custom tooling service to meet your needs. Write for new Davis general catalog, No. 304.

DAVIS BORING TOOL DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Line and Stub Boring Bars, Boring Heads, Block-Type Cutters, Planing and Turning Tools, and Special Production-Engineered Job Tooling.

GIDDINGS & LEWIS MACHINE TOOL DISTRIBUTORS AND DISTRICT SALES OFFICES

(Giddings & Lewis Overseas Distributors Located in All Manufacturing Centers of the World)

● Giddings & Lewis Distributor's Offices
(Letters indicate G & L Division's products handled)
- (G) G & L and HYPRO Division
- (C) Cincinnati Bickford Division
- (K) Kaukauna Machine & Foundry Division
- (D) Davis Boring Tool Division

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EUCLID, O.
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Eichman Machinery Co. (G, C, K)
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B. C. MacDonald & Co. (D)
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KOKOMO, IND.
Stout & Loman (D)
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OMAHA, NEB.
T. S. McShane Company,
Inc. (G, C, K, D)
1113 Howard St.

PHOENIX, ARIZ.
Wilson Machinery Corp. (G, C, K, D)
1006 South 24th St.

PITTSBURGH, PENN.
Brown & Zortman Machinery Co. (C)
S. Second & McKean Sts.

The Motch & Merryweather
Machry. Co. (G, K, D)
717 Liberty Ave.

PORTLAND, ORE.
Star Machinery Co. (G, C, K, D)
801 Southwest Front Ave.

ST. LOUIS, MO.
Hoffman-Marquard Machy.
Co. (G, C, K)
1525-27 North Broadway

B. C. MacDonald & Company (D)
3829 West Pine Blvd.

SALT LAKE CITY, UTAH
Todd Machinery Co. (G, C, K, D)
140 W. 2nd South St.

SAN FRANCISCO, CALIF.
Darling Machine Tool Co. (G, C, K, D)
2186 Palou Ave.

SEATTLE, WASH.
Star Machinery Co. (G, C, K, D)
241 Lander St.

SHREVEPORT, LA.
Frederic and Baker (G, C, K, D)
100 Edwards St.

SPOKANE, WASH.
Star Machinery Co. (G, C, K, D)
East 415 Sprague Ave.

SYRACUSE N. Y.
Rudel Machy. Co., Inc. (G, C, K)
C. H. Briggs Division
114 South Warren St.

J. R. Stewart Co., Inc. (D)
532 University Bldg.

TULSA, OKLA.
Gorton-Howell Machy. Co. (G, C, K, D)
215-217 East First St.

WEST HARTFORD, CONN.
Rudel Machy. Co., Inc. (G, C, K)
7 South Main St.

WICHITA, KAN.
Eichman Machinery Co. (G, C)
323 West Murdock

B. C. MacDonald & Co. (D)
519 South Broadway

WYNNEWOOD, PENN.
Machinery Associates, Inc.
(G, C, K, D)
325 East Lancaster Ave.

CANADA

EDMONTON, ALTA.
Rudel Machy. Co., Ltd. (G, K, D)
6803 - 104th St.

Upton Bradeen & James Ltd. (C)
10310 - 109th St.

FORT WILLIAM, ONTARIO
Rudel Machy. Co., Ltd. (G, K, D)
1408 Brown St.

HAMILTON, ONTARIO
Rudel Machy. Co., Ltd. (G, K, D)
P. O. Box 8

Upton Bradeen & James, Ltd. (C)
171 James Street, South

MONTREAL, QUEBEC
Rudel Machy. Co., Ltd. (G, K, D)
614 St. James Street West

Upton Bradeen & James, Ltd. (C)
8760 Verville St.

OTTAWA, ONTARIO
Upton Bradeen & James, Ltd. (C)
77 Metcalfe St.

QUEBEC CITY, CANADA
Rudel Machy. Co., Ltd. (G, K, D)
995 Begin Ave.

TORONTO, ONTARIO
Rudel Machy. Co., Ltd. (G, K, D)
260 Fleet Street, East

Upton Bradeen & James, Ltd. (C)
890 Yonge St.

VANCOUVER, B. C.
Rudel Machy. Co., Ltd. (G, K, D)
535 Hastings St. E

Upton Bradeen & James, Ltd. (C)
215 West Second Ave.

WINDSOR, ONTARIO
Rudel Machy. Co., Ltd. (G, K, D)
606 Security Building

Upton Bradeen & James, Ltd. (C)
624 Chilver Road

WINNIPEG, MANITOBA
Upton Bradeen & James, Ltd. (C)
612 Broadway Ave.

GIDDINGS & LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN

Printed in U.S.A.

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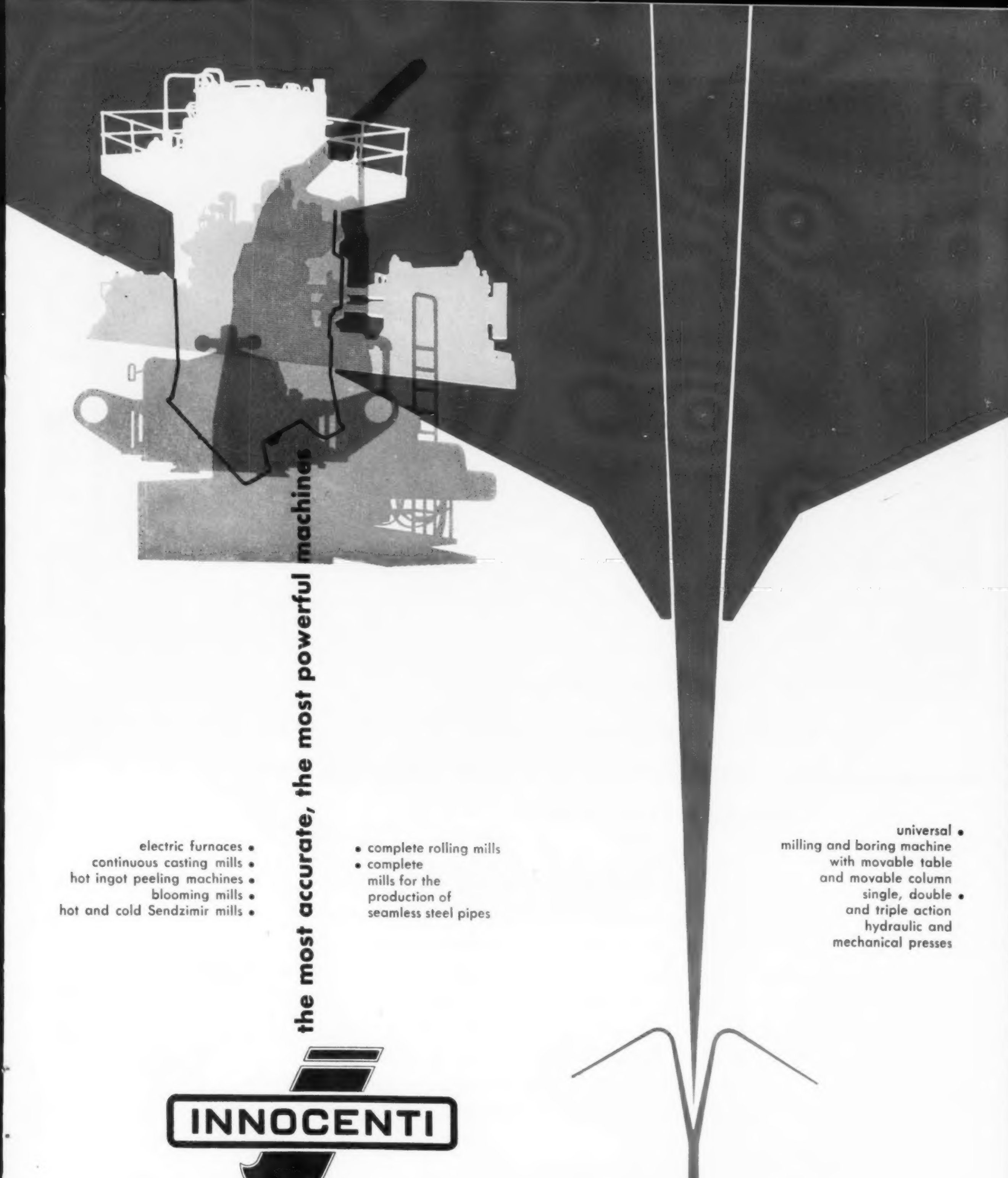
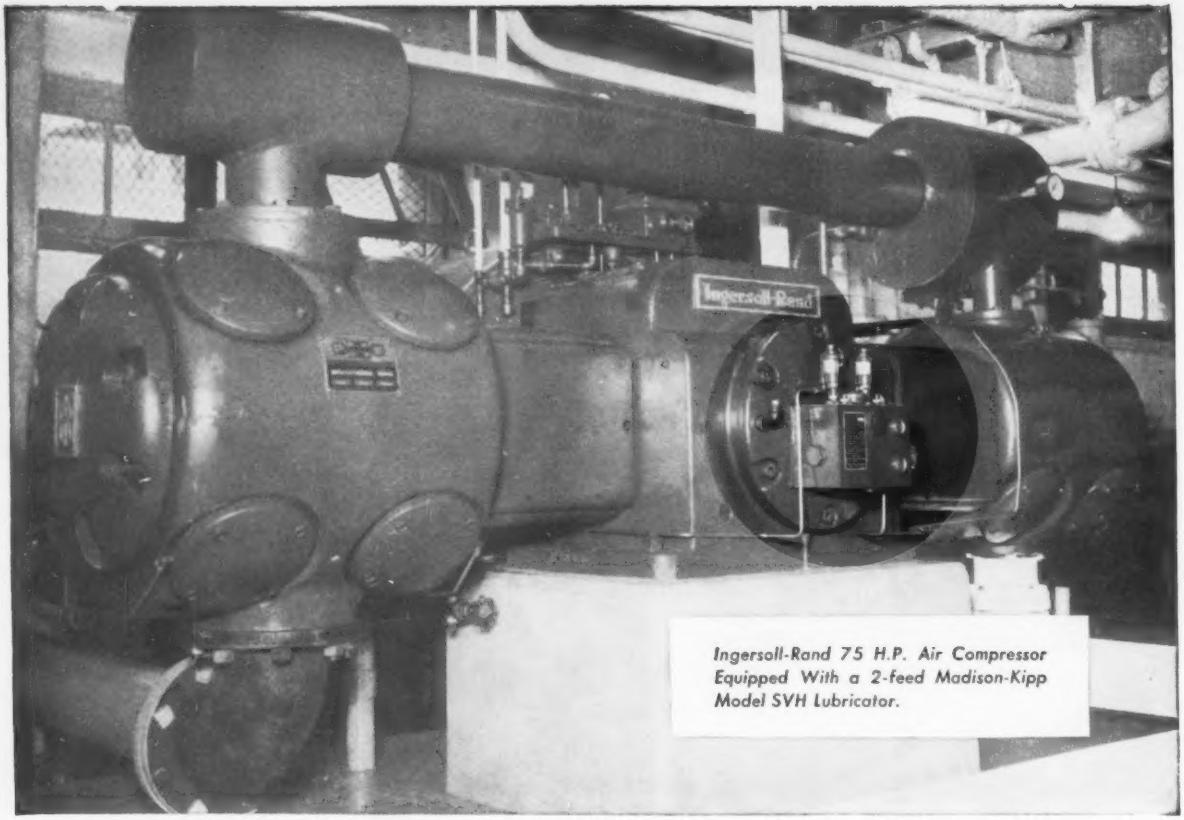
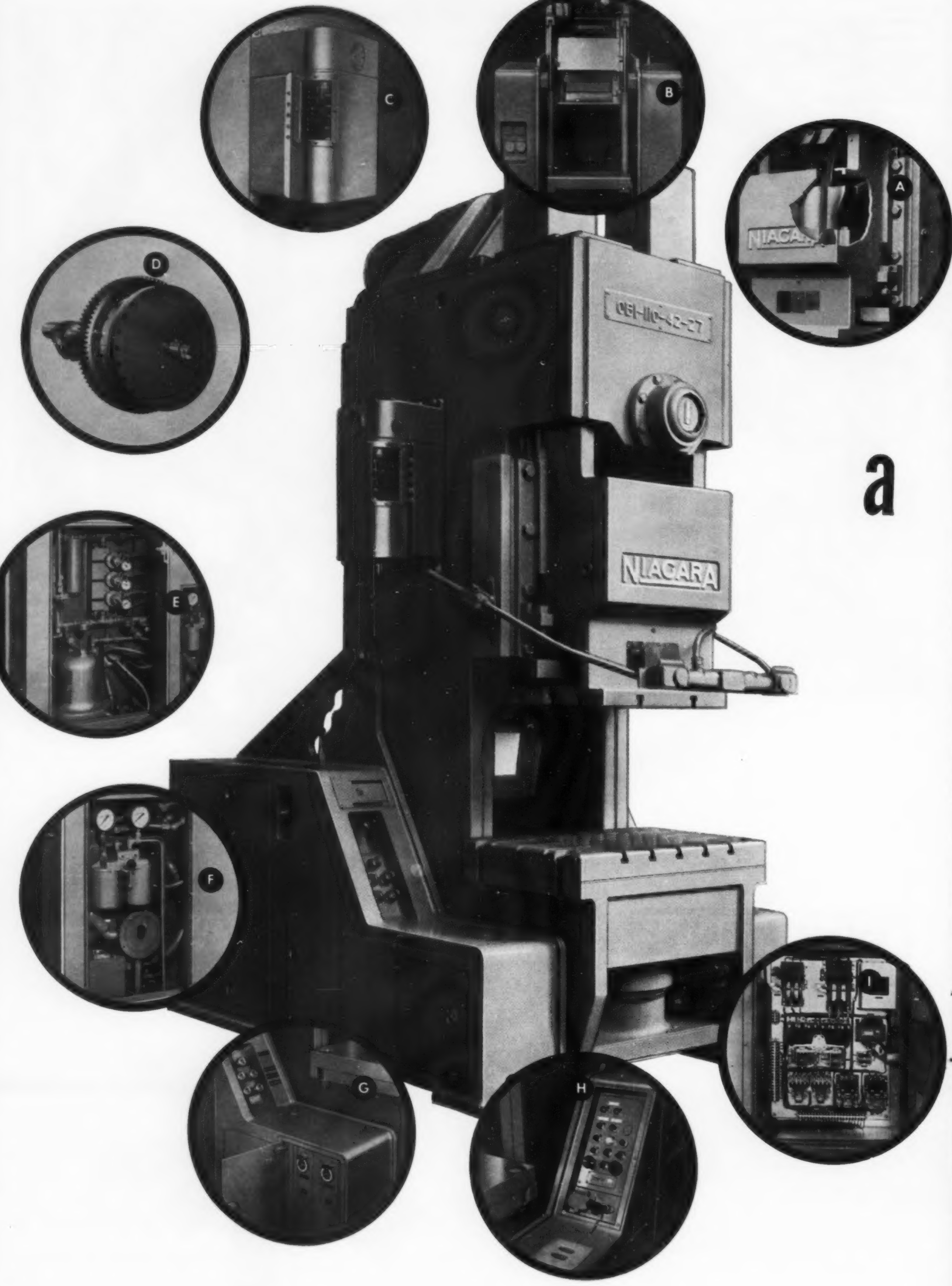

the best known the most accurate, the most powerful machines
electric furnaces • continuous casting mills • hot ingot peeling machines • blooming mills • hot and cold Sendzimir mills •
• complete rolling mills • complete mills for the production of seamless steel pipes
universal • milling and boring machine with movable table and movable column
single, double • and triple action hydraulic and mechanical presses
INNOCENTI
works: milan-italy
società generale per l'industria metallurgica e meccanica



Ingersoll-Rand 75 H.P. Air Compressor Equipped With a 2-feed Madison-Kipp Model SVH Lubricator.

For more information fill in page number on Inquiry Card, on page 233

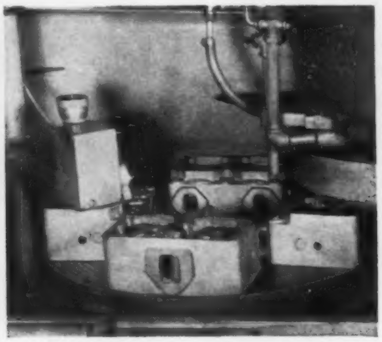

• universal milling and boring machine with movable table and movable column
• single, double and triple action hydraulic and mechanical presses
blooming mills •
hot and cold Sendzimir mills •
electric furnace •
continuous casting mills •
hot ingot peeling machines •
complete rolling mills •
complete mills for the production of seamless pipes •
INNOCENTI
the best known, the most accurate, the most powerful machines
works in milan (italy)



a

Whatever your grinding job may be...

200 adjusting screw washers are ground on one side in one hour. Stock removal .025"; limits ± .001".



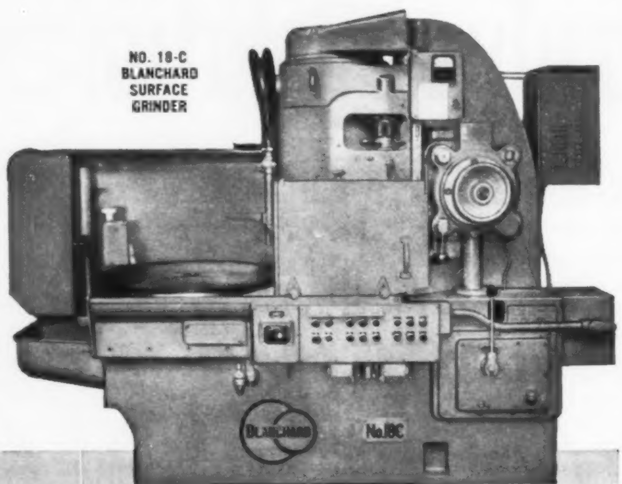
Tops of cylinder heads ground 21 per hour; stock removal 3/16" to 1/4". Bottoms 55 per hour; stock .012"; limits ± .001".

56 cast iron plates are ground on one side in one hour. Stock removal .140"; limits .001".

for best results...

The Blanchard No. 18-C Surface Grinder has the speed and precision that guarantees economical grinding on an endless variety of jobs. After the initial setup, the automatic cycle handles every operation from start to finish. The operator is freed to prepare the next load or to operate a second No. 18-C Grinder.

NO. 18-C BLANCHARD SURFACE GRINDER



Put it on the Blanchard

The 18-C Automatic Cycle...

- Moves chuck to grinding position and starts it rotating
- Starts wheel rotation and coolant pump
- Provides rapid wheel approach to work
- Engages power down-feed at preset rate
- Changes to fine feed just before finished size is reached
- Stops feed when work is to size —"sparks" out. Raises wheelhead
- Stops wheel, coolant pump, and chuck
- Moves chuck to loading position — demagnetizes chuck
- Can be changed quickly to manual operation

Automatically Controls Size!

Send today for your free copy of 18-C folder.

BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

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Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

FISHER GOVERNOR CUTS TIME ON VALVE PARTS

Hydraulic drive gives turret lathes completely automatic operation

How important is a planned equipment replacement program? Here's a concrete example:

The Fisher Governor Company's Marshalltown, Iowa, plant—one of the most modern in the Midwest—adds almost $500,000.00 annually in new and improved equipment. In effect many years, this program pays off in improved quality, lower production costs, and a stronger competitive position. Recent additions are two Gisholt No. 5 MASTERLINE Ram Type Turret Lathes, equipped with hydraulic drive units to make the machines completely automatic.

Here's how they are used to produce 1″-size valve bonnets from 2½″ steel bar stock. For the first operation, stock is automatically advanced through the spindle and gripped in a collet chuck. All external and internal surfaces in section A are then machined by hexagon turret and cross-slide tooling. Reverse-feed is used to finish-turn and finish-bore.

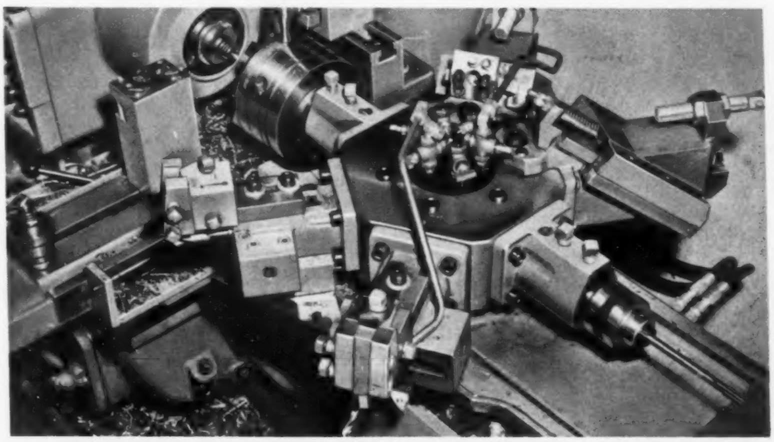
Chips are removed during drilling by recipromatic action of the hydraulic control, withdrawing the drill automatically at predetermined intervals. The drill is then rapid-traversed back to where it stopped drilling before resuming feed. The large O.D. is threaded from the hex turret, using a self-releasing die-head automatically recocked after each threading operation.

Internal grooving operations are handled by a turret-mounted slide tool, actuated during turret movement by an overhead positive stop. At the end of the cycle a basket on the final turret station catches the part as it is cut off, and the cycle automatically repeats until new bar stock is needed. Floor-to-floor time is a fast 3.6 minutes.

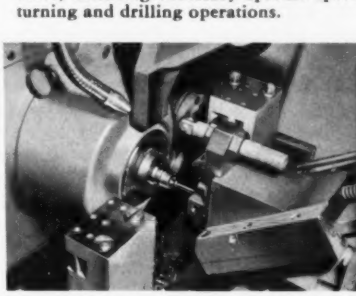
The second No. 5 lathe, equipped with a collet chuck, handles machining operations on the other end. Hexagon turret and cross-slide tools machine all internal and external surfaces in section B. The small O.D. is threaded and grooves formed in the small bore by the same methods as in the first operation. Floor-to-floor time is just 2.4 minutes.

***One operator handles both machines.** Hydraulic drive provides completely automatic operation; repeats tolerances piece after piece; offers uniform quality, longer tool life.*

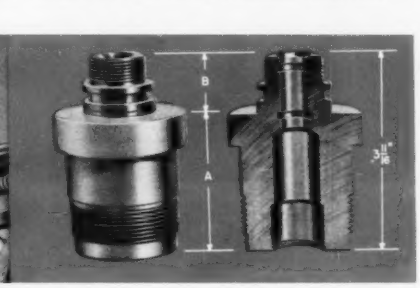
Ask for new Catalog 1182-A on Hydraulic Drive for Ram Type Turret Lathes.



Second operation tooling. All machine functions automatically controlled by automatic drive, including necessary spindle speed changes for threading, reaming, grooving, turning and drilling operations.



Close-up shows special slide tool, actuated by overhead stop. Forward movement of turret translated into vertical movement of tool to perform internal grooving.



Two finished valve bonnets. One on right is sawed in half to show all surfaces machined in both operations.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

GISHOLT LEADS THE WAY

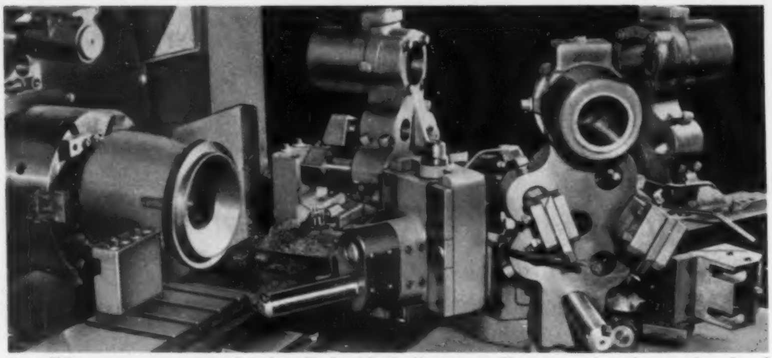
BYRON-JACKSON DIVISION MACHINES PUMP CASES 75% FASTER

Special slide tools on 2F Fastermatic speed taper facing

This setup demonstrates how Byron-Jackson Division of Borg-Warner Corporation, Lawrenceburg, Ind., uses an automatic turret lathe to handle five different sizes of cast iron pump cases, machined in lots of 1,000. The first operation, on a typical part 10³⁄₃₂" long and 11¼" in diam., is shown.

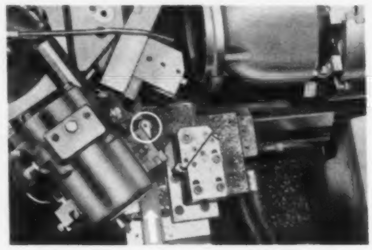
The work is located from the end and chucked in the large I.D., using a three-jaw air chuck. Standard tools on the hexagon turret and front and rear cross slides handle straight turning, facing, boring and chamfering operations on the flange end. A turret-facing attachment on the rear cross slide operates two special turret-mounted facing slide tools, to rough and finish the tapered face. Tools for boring, shave-facing and forming are carried on the same turret station. The bore is completed at a high RPM. Then the spindle changes to a lower speed as the tools face and form and then dwell to clean up the cuts.

A fixture is used for the second operation. An adapter centralizes on the machined hub, locating against the finished flange face as draw-back clamps hold on the opposite side. The turret facing attachment and special slide tools again machine internal surfaces which cannot be reached by standard tooling. A low speed and dwell again cleans up a shave-facing cut. F.t.f. time 7.5 minutes.



Five different pump casing sizes handled with similar setup. First operation shown. Overhead piloted tools used for greater accuracy on multiple cuts.

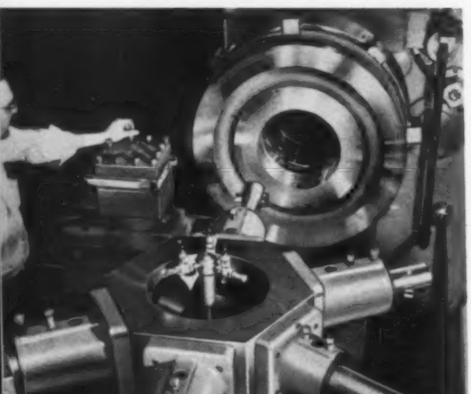
Special slide tools face taper accurately at low cost. Change to low spindle speed and dwell at end of cut cleans up surfaces, promotes greater accuracy, saves extra passes at the work.



Special turret-mounted facing slide tool is operated by turret-facing attachment on rear cross slide. Operating end of pusher arm encircled. Tool carrying slide set at angle to centerline for desired taper on face.

MANNING, MAXWELL AND MOORE CUTS TIME 71%

Speeds production on 32" wheels with special 5L lathe



Note size of part compared to operator. Cross-feeding turret on the Gisholt 5L permits use of standard tools for cross-facing and grooving operations.

This job story shows how a seven-hour f.t.f. time was reduced to two hours. It reveals how Manning, Maxwell and Moore, Inc., Shaw-Box Crane & Hoist Division, of Muskegon, Mich., uses a Gisholt 5L with a 50 h.p. drive motor to gain full advantage of the versatility and operating economy of a horizontal turret lathe on operations requiring heavy stock removal.

The 5L is equipped with a raised headstock and hexagon turret, providing 45" swing over the ways to handle a variety of large-diameter parts. Cross-slide travel is 18½" out from the center line. A cross-feeding hexagon turret permits use of standard boring bars and tools to handle grooving operations, cross-facing, etc. "Tenth" indicators and longitudinal feed dials on the cross-slide and turret carriages speed tool positioning. Taper attachments on both carriages simplify angular turning and boring. A chasing attachment on the turret carriage assures accuracy in threading operation.

Let's look at the setup for a typical part—a 32"-diameter, 6½"-wide rolled steel control gate wheel heat-treated to 321-363 Brinell. These wheels are for the St. Lawrence Waterway System, and used in the "Shaw-Box" line of overhead traveling cranes. Four hand clamps on the O.D. of a 32", four-jaw independent chuck pull the part back, locating it against the chuck jaw faces before chucking. The square turret on the cross-slide handles all O.D. taper turning and forming cuts. Hex turret tools cross-face and bore, groove the center of the 12½" bore, and machine a 2 t.p.i. oil groove for the length of the bore. The part is then reversed and similar facing, turning and forming are performed on the other side to complete the job.

This setup removes 270 pounds of metal in two operations, saving five hours over previous methods. Again, a new machine with sufficient capacity, horsepower and proper accessories has meant lower production costs and new operating economy.

GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

TO PROFITABLE PRODUCTION

TIME-SAVING IDEAS

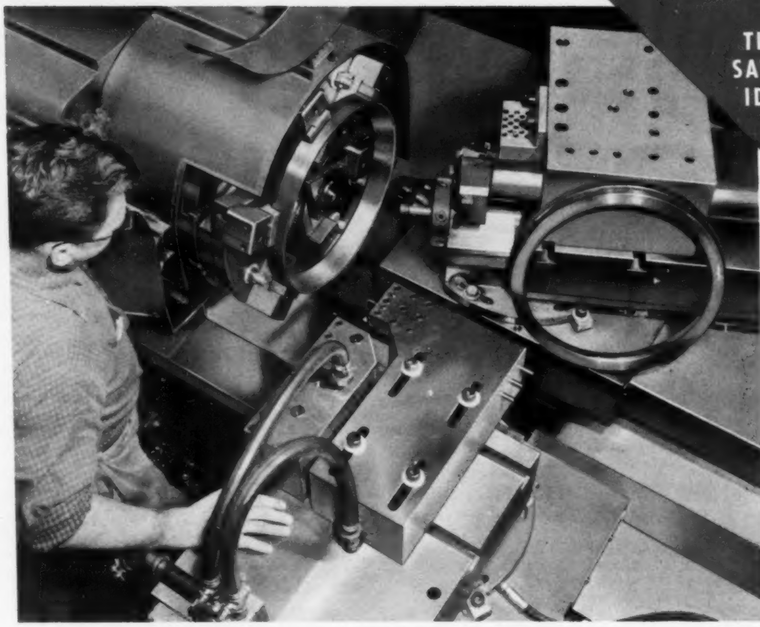
TORRINGTON SPEEDS BEARING RACE MACHINING 30%

Handles variety of types and sizes with minimum change-over on No. 24 Automatic

You'll spot cost-saving ideas here for machining large-diameter, thin-wall parts. The Torrington Company's South Bend, Indiana, plant is using this setup on a Gisholt MASTERLINE No. 24 Automatic Production Lathe to produce a variety of inner and outer bearing races.

To hold the parts without distortion, a 24", three-jaw air chuck grips at six points on the O.D. Each chuck jaw mounts a pie-shaped swivel plate carrying two top jaws with loosely held steel contact pads. The part locates against the back of the top jaws, with the contact pads automatically adjusting themselves to irregularities and—working with the swivel plate—equalizing pressure to centralize the part during chucking.

In the first operation on the No. 24, this 15¾"-diameter outer bearing race is faced on one end and the O.D. turned up to the jaws. In the second operation (illustrated), the part is chucked on the previously machined O.D., locating against the machined face. Using standard longitudinal carriage feed, tools on the front slide turn the remainder of the O.D. Then, standard slide movement feeds the tools transversely, out from center, facing the end and forming an inside radius. Tools on the rear independent slide then taper-bore and form a radius on the O.D. to complete the operation. Floor-to-floor time on this well planned job is a fast, profitable three minutes.



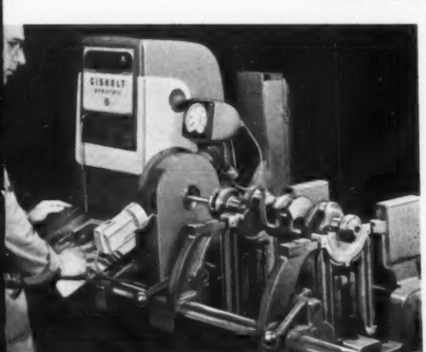
15¾"-diameter outer bearing race in chuck. First operation part at right. Note elongated slots on front tool block and boring tool holder, designed for quick adjustment to handle variety of work sizes.

Swivel bases on front and rear slides speed angular setting. With facing and forming tools on the front slide in separate adjustable block, and boring tools on the rear slide in adjustable bar, setup is faster for a variety of part diameters requiring different length cuts.

This machine handles 60 different part sizes. Chucking arrangement eliminates distortion, improves accuracy. Swivel base tool slides and adjustable tooling speeds change-over, helps reduce over-all f.t.f. time 30%.

HOW SIMCA SIMPLIFIES CRANKSHAFT BALANCING

End drive on 3S Balancer speeds handling of crankshafts



Crankshaft shown arranged with end drive which speeds loading and unloading. Note strobe angle-indication lamp and amount meter in the same visual plane to assure quick, efficient reading.

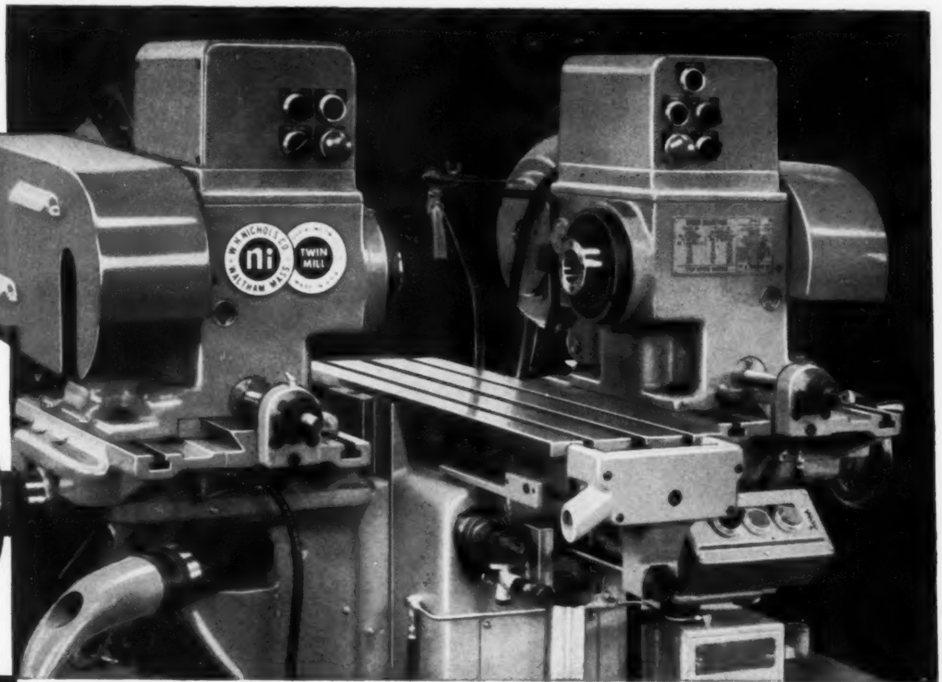
With the installation of two Gisholt 3S Balancers, Automobiles SIMCA, Nanterre (Seine), France, has stepped up crankshaft balancing operations. To speed loading and unloading of the relatively long workpieces, a special end-coupling type of drive is used on the machine, rather than the standard belt drive.

The end-drive coupling has an angularly graduated driving pulley in the housing below the direct reading amount meter. Angle of unbalance is indicated by the strobe lamp, and the amount of correction needed is shown by the direct reading amount meter—which is calibrated in terms of method used to correct the part (in this case, by drilling).

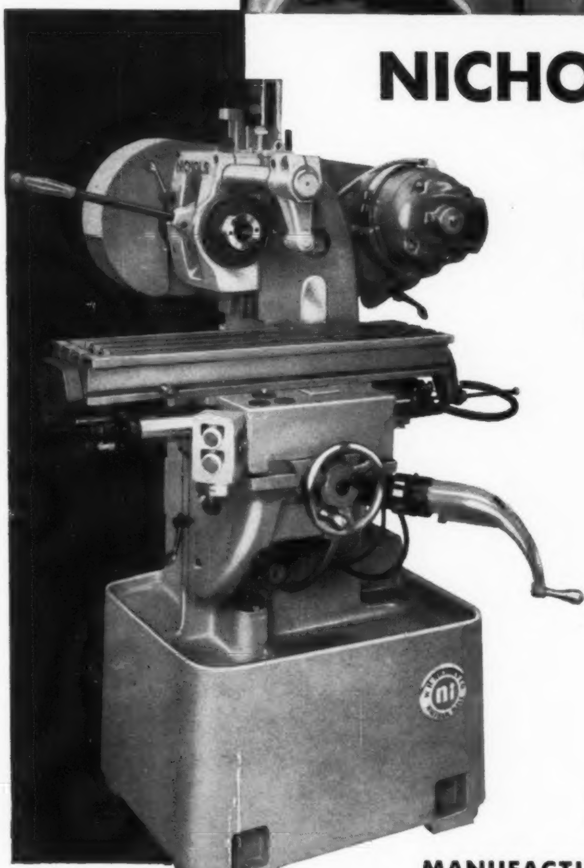
After a part is rotated and checked for unbalance amount and angle, the operator removes it from the machine and corrects it on a drill press. With each operator measuring the amount of unbalance and the angle, and performing his own correction, possibility of error is minimized. This arrangement permits balancing 50 to 52 crankshafts per hour with the two Gisholt 3S Balancers.

Gisholt Type S Horizontal Balancer readily adapts from belt drive to end drive, with no loss in accuracy—ideal for long workpieces not adaptable to rotation by standard belt drive. Amount meter calibrated in terms of correction drill depth eliminates lengthy computation by the operator.

TALK TO GISHOLT ABOUT MACHINE TOOL LEASING



Twin Mill



Nichols 8SA
Semi-automatic

NICHOLS MILLERS . . .

Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic down-feed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you?

MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors **THE ROBERT E. MORRIS COMPANY**

REM SALES DIVISION

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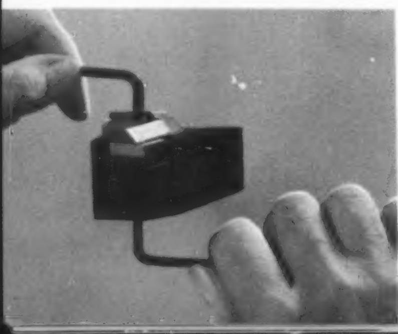
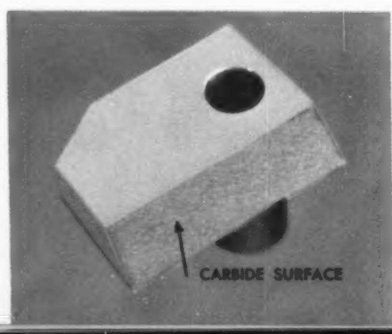
1 New! Self-loosening chipbreaker clamp. A twist of the wrist releases insert for indexing . . . automatically lifts and lowers chipbreaker. No more prying chipbreaker free. No more fumbling with loose chipbreaker. Choice of 3 chipbreaker widths for accurate chip control.

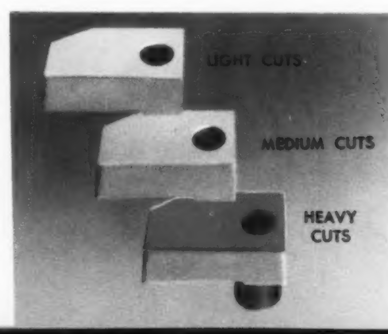
2 New! Setscrew accessible from top or bottom! Screw easily reached when holder is upside down or on its side. Easier indexing from any position.



3 New! Unique carbide-surfaced chipbreaker. New method bonds carbide coating directly to chipbreaker. Ends all possibility of braze failure.



4 New! Three color-coded chipbreakers. Choice of three widths: yellow for light cuts, silver for medium cuts, red for heavy cuts. Makes identification easy.



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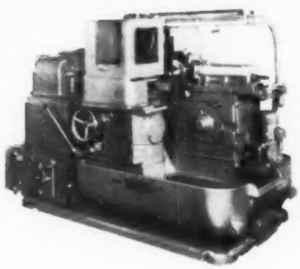
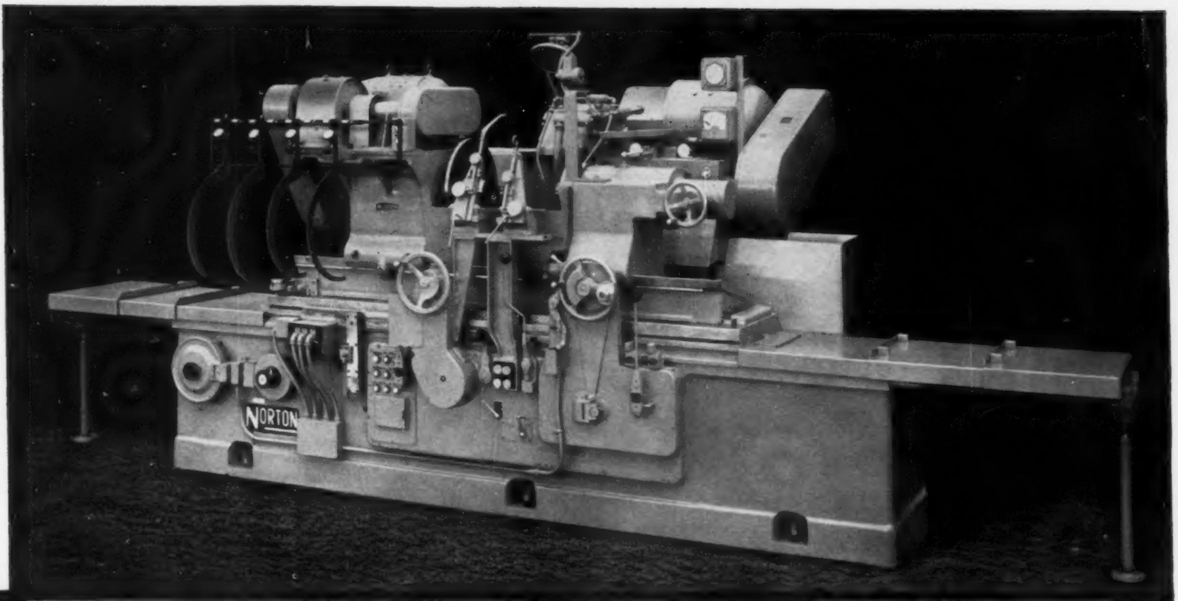


AUTOMATIC FEEDS of various types can be easily applied to TAREX Automatics as they are designed to mount feeds in almost *any* position . . . including the front and rear slides or in the oblique position; also at the rear of the turret as well as to feed parts through the headstock.

All provision has been made for mounting of automatic feeds as well as other auxiliary attachments.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



The new Norton 30″ Type LCTU Semiautomatic Cylindrical Grinder is expertly engineered to improve your grinding operations on ***large-diameter parts of relatively light weight.***

It does this by bringing you maximum speed, accuracy, operating ease and economy — typical Norton "Touch of Gold" advantages that mean top-quality, lowest cost production.

Advanced Features

- Automatic grinding cycle, under one-lever control, assures fast, consistent output and reduces operating effort. Electrically timed termination of the cycle can be shifted to manual control.
- Start-stop of work rotation and coolant flow controlled automatically with the grinding cycle or manually, as desired.
- The rugged wheel spindle and sturdy work supporting units combine with the precision wheel feed mechanism to produce fast die-out with exceptional repetitive accuracy in sizing.
- Pre-set speed control permits separate table speeds for truing and grinding as set from the first workpiece. Thereafter, either speed is instantly provided by moving the table control lever.
- All controls for feeds and speeds easily accessible from front of machine. Automatic or manual wheel feed settings speeded by "click-count" index, enabling settings for work diameter reduction in increments as fine as .0001″. Handy work jogging lever permits fractional rotation of the work for most convenient loading or inspection.

Many Accessories

are available to increase the efficiency of the 30″ Type LCTU for special jobs. Optional extras include locating devices, automatic wheel truing, automatic compensation of wheel head setting after truing and a lever-operated device for moving the grinding wheel into a shoulder to be ground.

To Meet Your Competition

Obsolete grinding equipment is a business risk. Why not get all the facts on how the new, highly advanced 30″ Type LCTU Grinder can aid in improving your competitive position? See your Norton Representative or write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

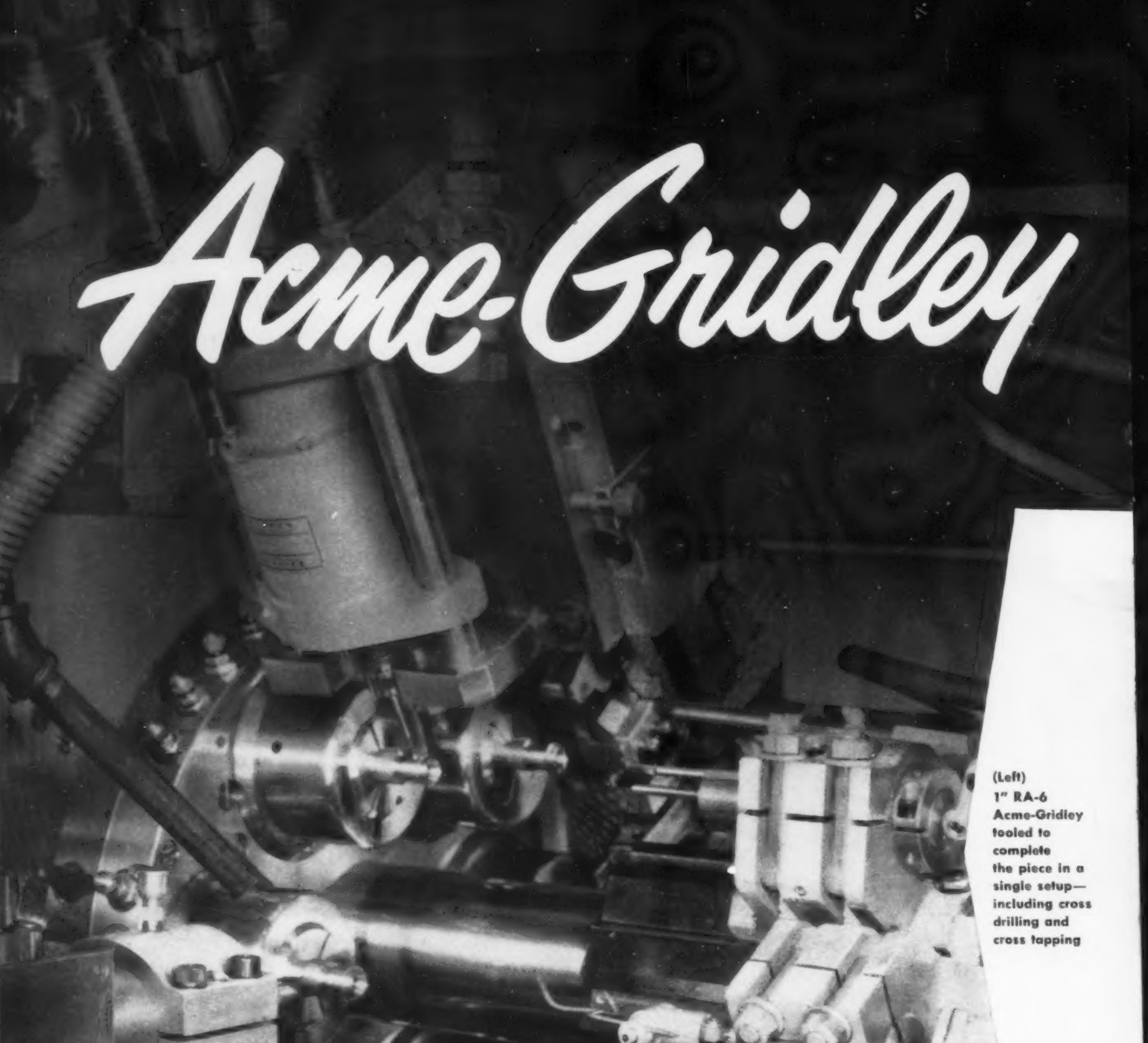
To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

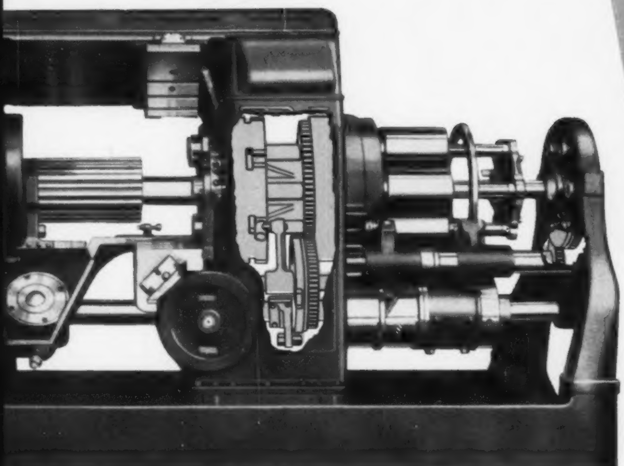
NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes



(Left)
1" RA-6 Acme-Gridley tooled to complete the piece in a single setup—including cross drilling and cross tapping

shockless indexing combined with independently-powered stock reel..

gives greater sustained accuracy... longer machine life



Acme-Gridleys are at their productive best when performing "secondary" operations during the primary setup—operations which otherwise would require additional time, machine investment, and floor space.

On an Acme-Gridley you can perform operations that require "on-the-button" indexing—such as cross-drilling and cross-tapping in successive spindle positions—with the same fourth-decimal-point-accuracy at the end of the shift as at the start.

And—your Acme-Gridley has power and stamina to spare, at the highest speeds and feeds that modern cutting tools can safely stand.

SHOCKLESS, POSITIVE INDEXING of the spindle carrier at high speed is accomplished by a Geneva mechanism. Indexing starts smoothly from a standstill, rapidly accelerates, then decelerates and comes to a dead stop without shock. Accurate location and positive locking of the carrier is assured by the locking pin mechanism.

STOCK REEL IS INDEPENDENTLY POWER INDEXED through a separate shaft and gear. This eliminates torsional strain and any tendency to whipping action, which might cause excessive wear on spindles and spindle carrier.

LET US TELL YOU MORE ABOUT *Acme-Gridley* BASIC DESIGN

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY • 179 EAST 131ST STREET • CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan

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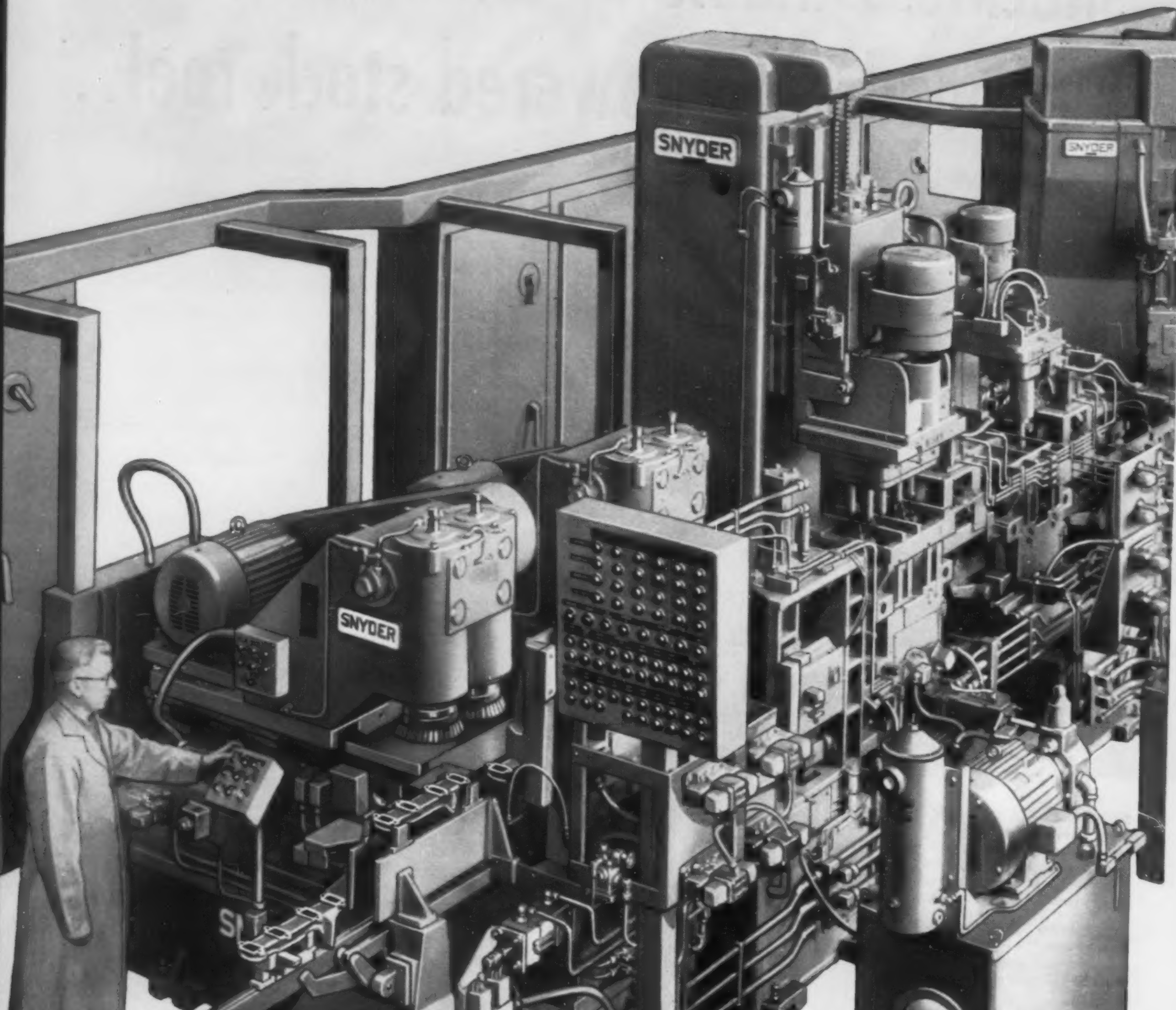
Two Different Exhaust Manifolds Processed by Snyder Special



New

ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

Embody... Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of Inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

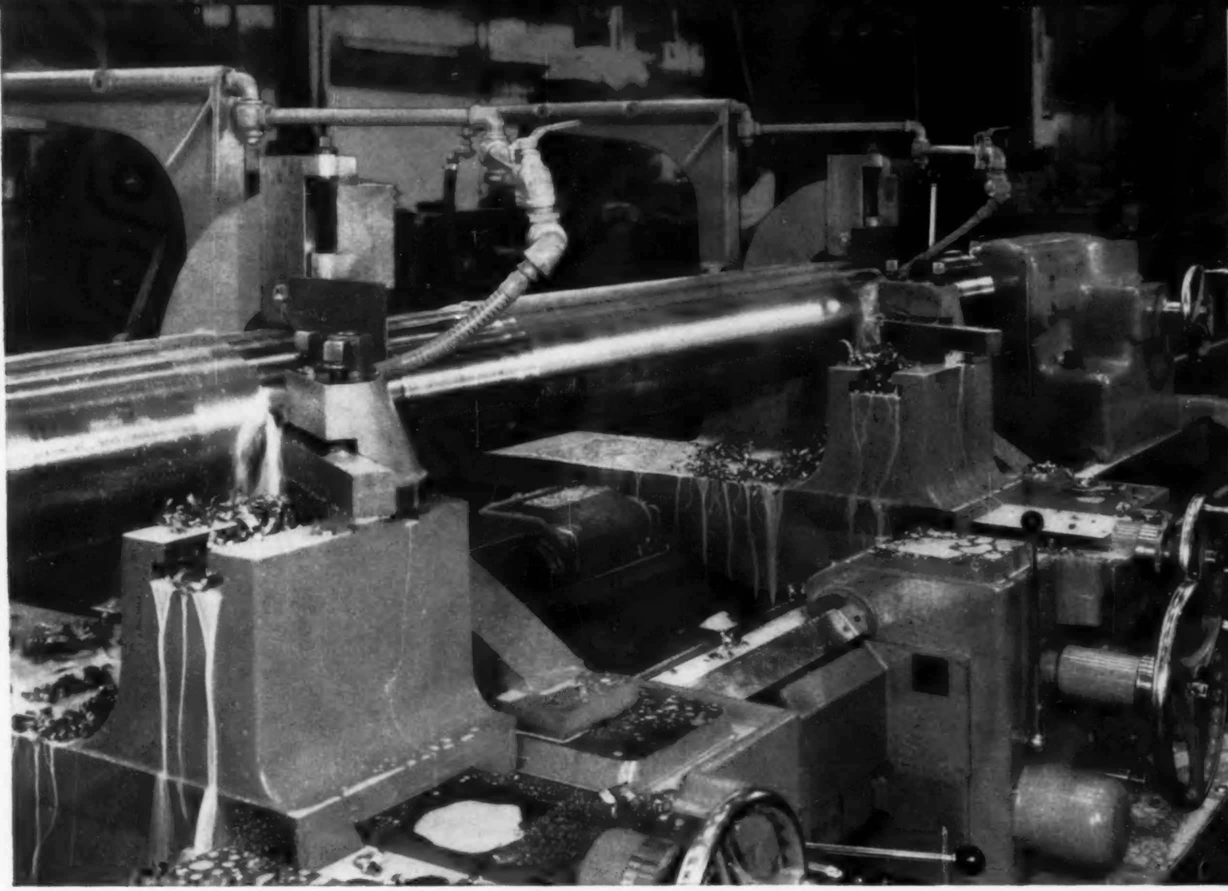
Write for catalog

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

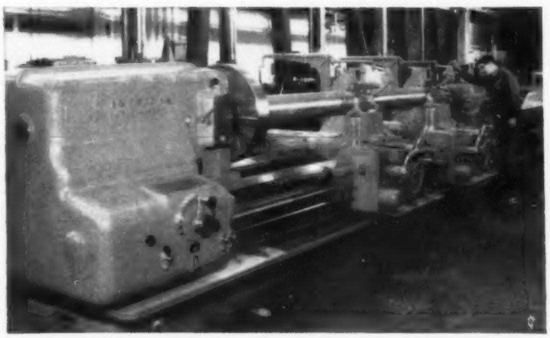
5213 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

For more information fill in page number on Inquiry Card, on page 233



Cutting with two Carriages equipped with plain block rests and follow rests.

MACHINING TITANIUM BILLETS



32 inch "American" Double Carriage Pacemaker Lathe.

An extremely difficult job — a real challenge to the rigidity, stamina and "staying" qualities of any lathe.

Cutting titanium offers terrific resistance to the cutting tool which in turn demands maximum rigidity of the tool supporting members in order to hold vibration to the very minimum; otherwise chatter and high tool mortality are inevitable.

The fact that all of the major titanium fabricators are using "AMERICAN" Lathes, selected only after repeated demonstrations, is conclusive testimony to the power, stamina and rigidity of these machines.

There are exclusive features which definitely contribute to this result, such as the wide, four vee bed with walls rigidly tied together between the girths by an angular web which forms a chute for quick disposal of chips; replaceable hardened tool steel vees; solid 3-vee mounting of the carriage on the bed; powerful headstock with triple bearing spindle and bearing adjustment from the outside and others which space limitations prevent mentioning.

For a complete description of all of these features just send for bulletin No. 144.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Using fast broaching speed and broaching two parts at once it is now possible to LAPOINTE the port faces on all surfaces of this

This remarkable production rate of less than 20 seconds each (at 80% efficiency) is achieved by a broaching speed of 120 feet-per-minute, allowing the operator an ample thirteen seconds to handle each part.

Carbide tooling . . . chatterless broaching. Carbide tipped tool bits and solid carbide blades remove approximately 5/32″ stock on each surface (and that adds up to a lot of cubic inches!) Carbide tooling is entirely practical at the rapid broaching speeds for which Lapointe-built machines, equipped with electro-mechanical drive, are designed. In the production of automotive parts, where a saving of pennies on any operation builds up to a staggering annual figure, it is essential to make each moment count!

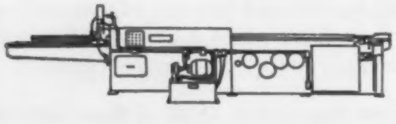
Lapointe has eased the burdens of production executives in the automotive industry for a great many years — not only by substantially stepping up production but also by taking full responsibility for the entire broaching program, including the building of the broaching machines, the fixtures and the broaches. Why not ask a Lapointe Field Engineer to discuss modern broaching with you?

THE LAPOINTE MACHINE TOOL COMPANY

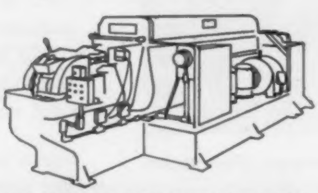
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

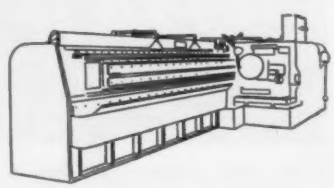
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60″ STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

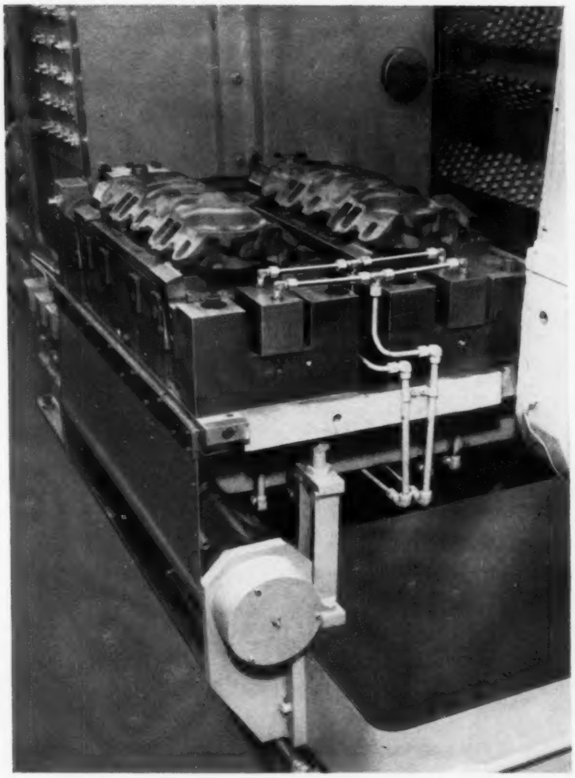


SRHE SINGLE RAM HORIZONTAL, ELECTRIC

–BROACH

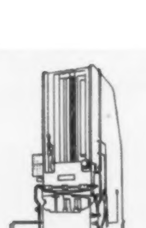
INLET MANIFOLD

at 206 parts per hour!

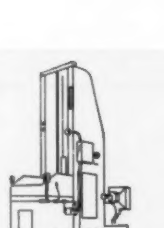


LAPOINTE SRHE, 150-inch stroke Single Ram Horizontal Broaching Machine with Electro-mechanical Drive. Equipped with positive action oscillating chip conveyor complete with trough. Note the protective guards.

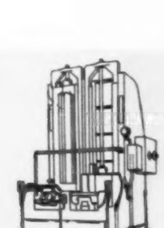
Two manifolds are completely broached at each cycle of the machine, through the use of this double work-holding unit (hydraulically operated), together with a wide 24-inch slide on which two sets of broaches are mounted.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

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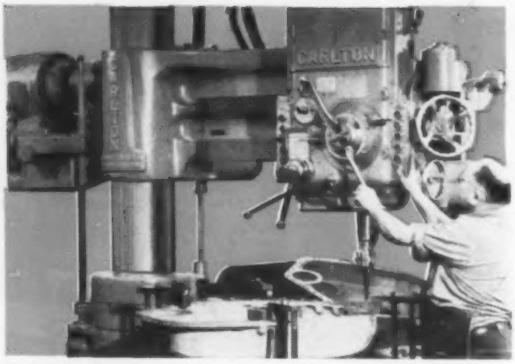
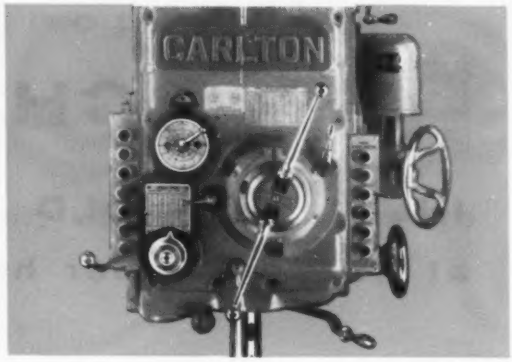
now take your choice of 4 different speed-feed controls



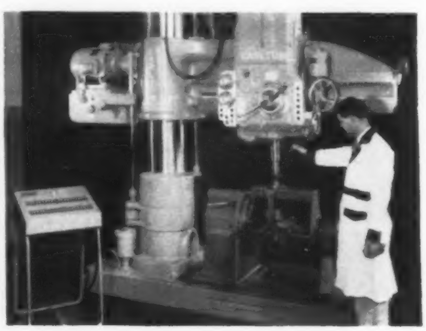
1 ***Manual*** 2 shifter levers for controlling speeds, 2 for controlling feeds.



2 ***Partial pre-selector*** 1 dial and 1 lever selects 36 spindle speeds. Feeds selected manually.

Programming pre-selects speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

Operator is free to concentrate on starting and stopping spindle, changing cutting tools . . . speeds and feeds having been pre-set.

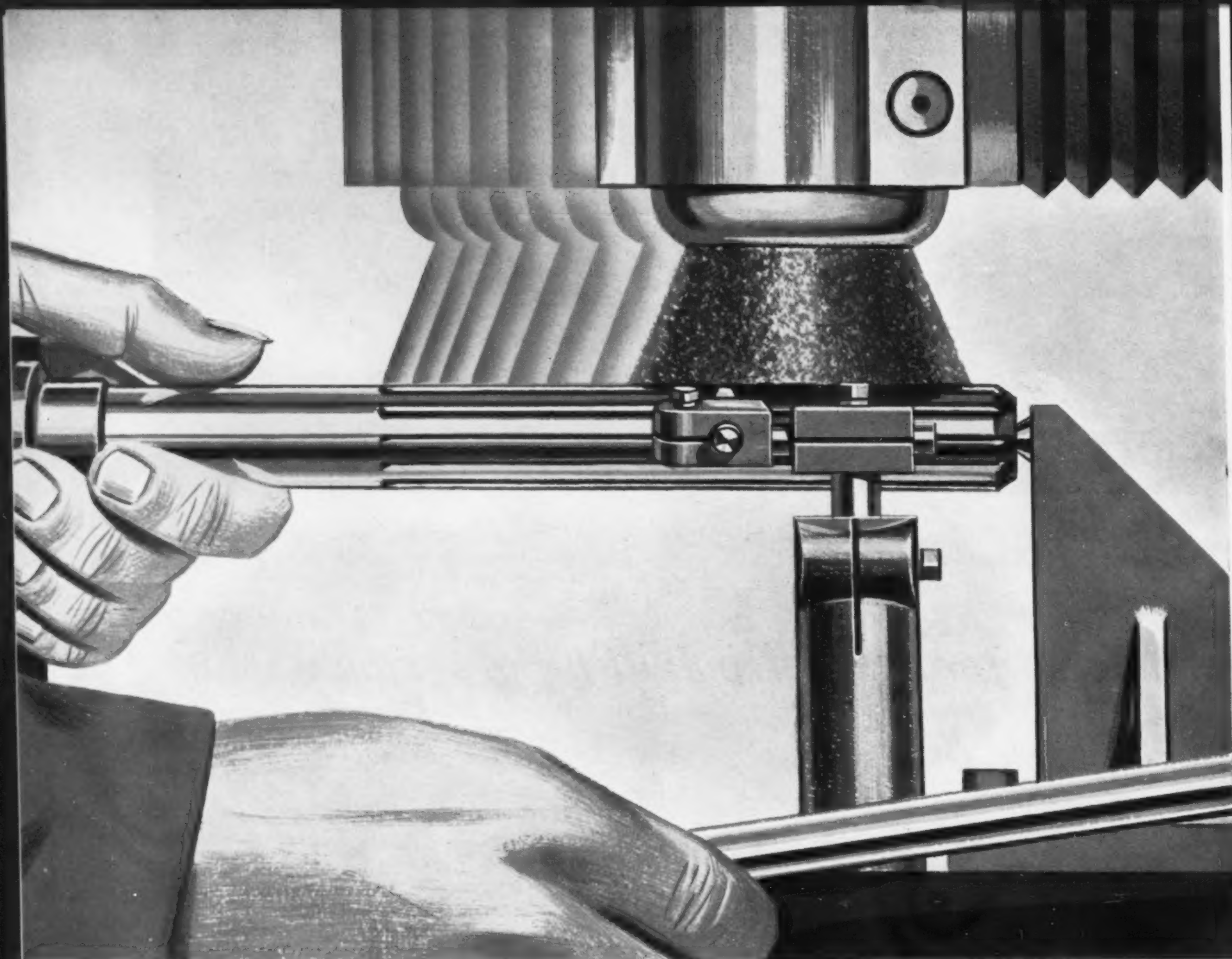


plan and pre-set speeds ...with

Carlton

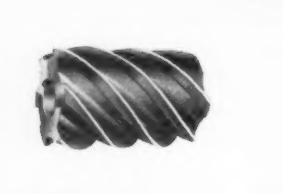
Now you can choose exactly the right radial drill speed-feed control for your requirements . . . from among the four now offered exclusively by The Carlton Machine Tool Co.:

Programming: Here's how the Carlton-Leber programming works: your production engineering department studies the workpiece drawing and determines the sequence of drilling operations and the correct speed and feed for each. This data is recorded on a routing sheet or blueprint and is transferred to the programming console.



Oliver "ACE" Tool and Cutter Grinder

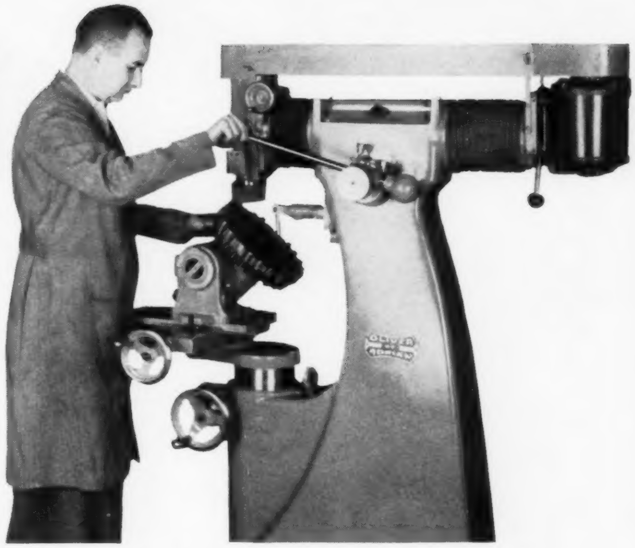
WHEEL TRAVERSES . . . *not the work!*



Face mills, reamers, hobs, spot facers—all cutters straight or spiral—are quickly, easily and economically sharpened with the Oliver "Ace."

You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought *to the work,* reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head moves in special bearings and is fully enclosed, sealed against dust and dirt. Further accuracy is assured because the wheel can be trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a universal tool grinder designed expressly for tool grinding—not a general purpose machine *adapted* to tool room work. It is simple to set up. All clearance angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.



OLIVER Standard "ACE"

This machine is for high speed and light duty carbide grinding. Only two fixtures are required to handle a complete range of tool and cutter sharpening. Clearance angles are obtained by tilting the grinding wheel the desired amount as indicated on a scale graduated in degrees.

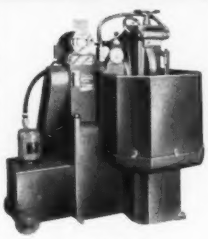
OLIVER Heavy-Duty "ACE"

. . . for grinding tungsten carbide cutters and tools in all of their many forms. Because it is for use with hard metals, all components have been designed with rugged going in mind. Like the standard "ACE," grinding is done on the top tooth, not on the side of the cutter. The operator has full vision at all times.

More **OLIVER** *of* **ADRIAN** *Tool Grinding Equipment*

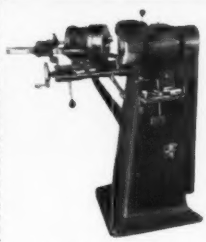
FACE MILL GRINDER

Completely automatic. A machine tool designed for accurate grinding. Wheel dressed with every stroke.



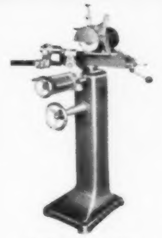
TEMPLATE TOOL BIT GRINDER

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.



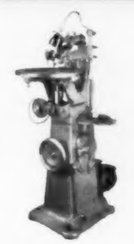
No. 510 DRILL POINTER

Semi-automatic. For drills 1/4" to 3" in diameter. No. 21 bench models available for size 1/2" and smaller.



DRILL POINT THINNER

For low cost reclaiming of drills. Corrects off-center and too-thick webs and out-of-index cutting edges.



DIE MAKING MACHINE

Produces dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. 5 designs in 2 types.

Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .

OLIVER of ADRIAN

OLIVER INSTRUMENT COMPANY

1410 E. Maumee St. • Adrian, Michigan

☐ Drill Pointer
☐ Face Mill Grinder
☐ "Ace" Universal Tool and Cutter Grinder
☐ Die Making Machine
☐ Drill Point Thinner
☐ Template Tool Bit Grinder

NAME______

COMPANY______

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Vibration won't loosen FLEXLOC self-locking nuts

Where products must be reliable . . . must stand up under vibration, temperature extremes and hard use . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts.

HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting locking action. And they are reusable: repeated removal and replacement, frequent adjustments, even rough screw threads will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes, types and materials to meet the most critical locknut requirements. Your local industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

We also manufacture precision titanium fasteners. Write for free booklet.

FLEXLOC® LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.
SPS
JENKINTOWN PENNSYLVANIA

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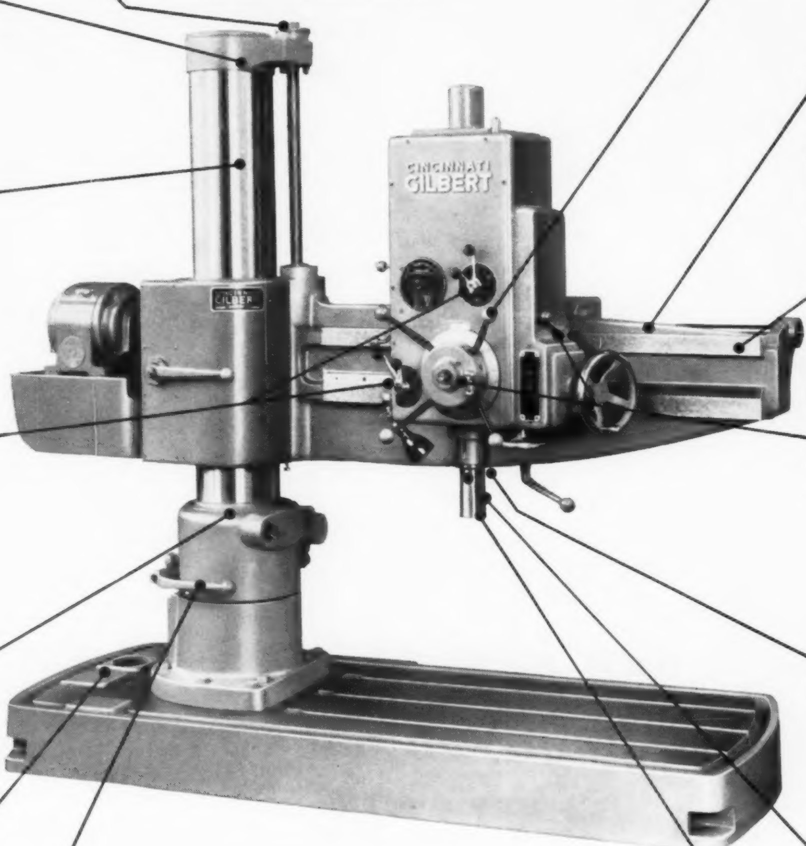
ONLY GILBERT RADIALS

OFFER ALL THESE FEATURES

When you order a Cincinnati Gilbert radial, you get more new features per dollar than any other radial can offer. And every feature is designed to give you maximum return on your investment—in performance, productivity, and dependability.



And don't overlook these additional features:

- wide range of spindle speeds for efficient tool performance;
- hardened gears throughout the machine;
- standard or special tap leads available;
- modern styling which reduces housekeeping, convinces customers that your shop is up-to-date.

Write or call for Bulletin 349.

those who buy Gilbert buy Gilbert again

THE CINCINNATI GILBERT MACHINE TOOL CO.
3346 BEEKMAN STREET, CINCINNATI 23, OHIO

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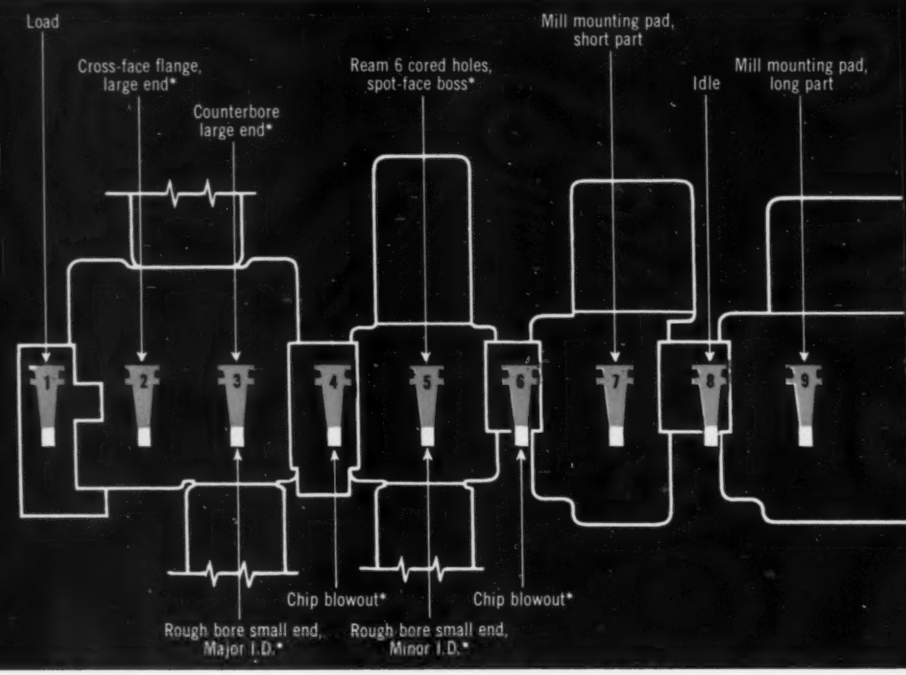
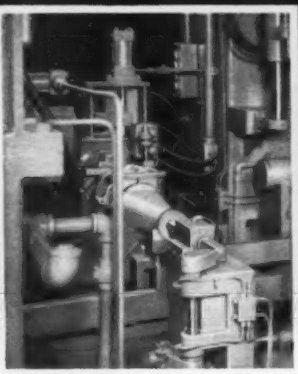
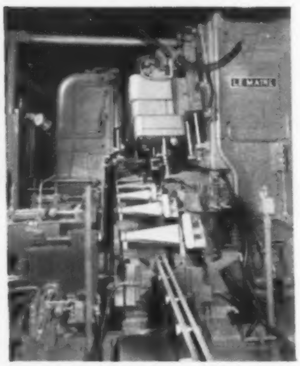
PRODUCING





Rotating station. Plate moves in, locates on part and trips limit switch, causing rotation for next operation.



Hardened pickup members hold part during transfer, locate it approximately prior to nesting in precision locators.

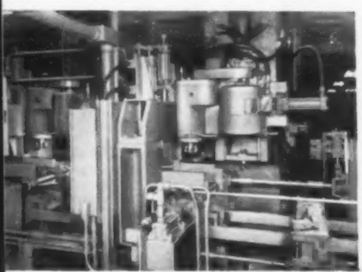
MACHINING TIME—20 SECONDS
CHANGEOVER TIME—ONE SECOND

This LeMaire 21-station transfer machine, installed by one of the automotive "Big Three," completely machines 180 aluminum transmission extensions per hour. It handles two different length parts . . . *and is changed over from one part length to the other with the one-second flip of a switch.*

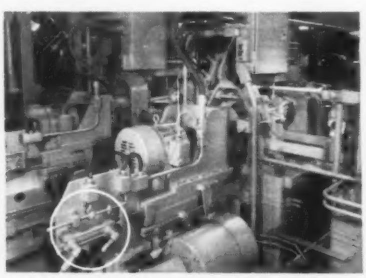
Most of the stations process both part lengths; others handle either the long or the short part exclusively. On the latter, parts which the station is not designed to process are passed automatically to the next operating station. Sensing devices, actuated by one selector switch on the main control panel, accomplish the changeover to machine different part lengths without manual adjustment of dog rails or limit switches, and without changing tool spacing, feeds or speeds.

Other features: • Walking beam transfer with hardened pickup members and precision hydraulic control • Unitized construction • Complete electrical interlock • Individual controls at each station • "PresTest" lights on main panel • LeMaire patented test panel in all control cabinets • Automatic lubrication • Electrical and hydraulic systems to J.I.C.

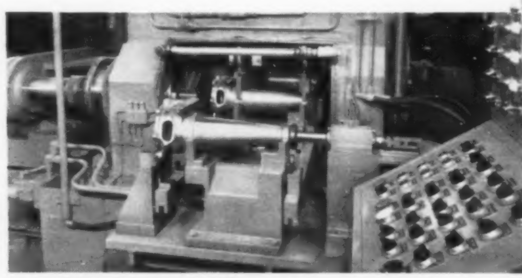
This is just one of many successful, *producing* installations designed, manufactured and tooled by LeMaire. Let us help with *your* production machining problems.



Station 7 (left) mills mounting pad on short part. For long parts, this station is automatically skipped for Station 9 (right).



Note hydraulic cylinder which re-positions dog rail on hydraulic slide unit for part length change. Actuated by selector switch on main panel.



Load station. Placing part in half locators depresses limit switch, causing interlock. Pressing cycle-start button causes walking beam pickup and transfer to No. 2.

The "RIGHT COMBINATION" for every reinforced grinding wheel

... because Norton builds the "TOUCH of GOLD" into it

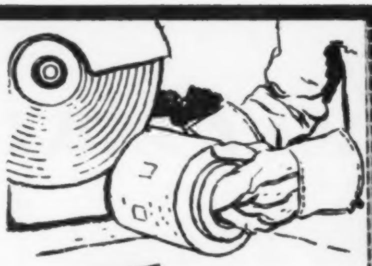
For every grinding, cutting-off or slotting job where you need a reinforced wheel, there's one Norton wheel that will do it best.

Norton helps you make more money by supplying a complete line of reinforced wheels. You get the size, the abrasive, the reinforcing web and the rubber or resinoid bond best suited to the work. Such a wheel puts the "Touch of Gold" in your hands for better production at lower costs.

... because Norton builds in Strength and Safety

These pages can't begin to show the many combinations to be found in Norton Reinforced Wheels, mounted wheels and points and sticks.

Norton makes so many varieties you can enjoy the just-right combination you're after. This "combination" lets you work fastest ... safest ... and most profitably. It's your advantage in dealing with the world's largest supplier of abrasives.



NEW

RN WHEELS
Glass Cloth

New — for the foundry and lower priced! Norton has been field-testing a new rubber-bonded-reinforced wheel. It's ready now and well worth your investigation for savings in your cutting-off operations on ferrous and non-ferrous metals.

NOW — as thin as 1/16"

BN WHEELS
Glass Cloth

Ten inch diameter wheels can now be had 1/16" and 3/32" thick. In this range specify A36TBN. For heavy duty work, requiring larger, thicker wheels, specify A24R14BN. Use them for slotting, for cutting-off non-ferrous metals, wire rope, many non metallic materials.

BD WHEELS
Glass-Nylon

For fastest cutting on right-angle grinders you'll want the glass cloth reinforced resinoid bonded hub wheels of rigid type. Use for medium to heavy weld grinding and smoothing flame-cut edges. Specify A24NBD for fast cut, A24QBD for long life. For cutting-off, A24RBD which is Nylon reinforced.

BFR WHEELS
Cotton-Nylon

Top performers for light, portable grinding. These semi-flexible resinoid wheels have cotton fabric with an additional layer of Nylon for added safety. Specify A24KBFR for weld smoothing, removing scale, light finishing, minor cut-off jobs, etc.

BF WHEELS
Cotton

These resinoid straight wheels with cotton fabric reinforcement are "the right combination" for peripheral grinding, do a fine job of deburring and finishing. Fine for blending and smoothing light welds. Also available in mounted wheels and sticks.

W-1809

Also, Reinforced Mounted Wheels and Sticks

See your Norton distributor for further facts about reinforced abrasive products. Ask him for Booklet No. 1748. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS

Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION:

Coated Abrasives • Sharpening Stones • Behr-cat Tapes

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DIXI 60

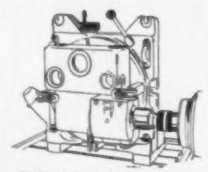
horizontal optical jig borer

The ONLY Horizontal Jig Borer Built Today! Combines the ACCURACY of the Vertical Spindle With the VERSATILITY of the Horizontal Spindle

ACCURATE:
Optical settings provide an overall accuracy of .0002.

VERSATILE:
Optical settings for operations in all planes and compound angles . . . equally suitable for tooling, short-run or production work . . . permits JIGLESS boring, facing, milling and drilling.

PRODUCTIVE:
Saves time, labor & costs . . . Unclamping, positioning, fine adjustment, reclamping and rechecking can be made in less than 10 seconds.



DIXI 450 Optical Precision Rotary table solves the problems of machining at compound angles.

5 OPTICAL MICROSCOPES

The DIXI Optical Reversing Process assures perfect alignment as well as round, taper-free holes. In work pieces with line bores on opposite sides, this is obtained by optically indexing the built-in rotary table 180°, locking the spindle feed and using the hydraulic table in-feed instead. Electrical infinitely variable speed spindle drive; infinitely variable hydraulic feeds; special features eliminate effect of spindle over hang on accuracy.

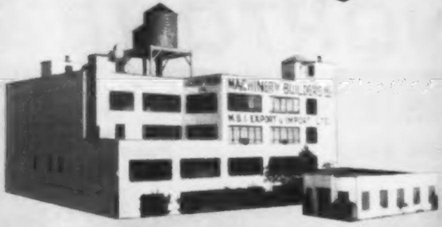
Made in Switzerland — All measurements in inches

- Guaranteed service by factory trained staff
- Engineering staff available for consultation
- Spare Parts in New York stock
- Your operators trained

DIXI 60 now in wide use in leading aircraft and manufacturing plants throughout the United States.

THIS VERSATILE MACHINE IN OPERATION at our New York, and other conveniently located Demonstration Centers.

Our Headquarters in New York City



MBI

M. B. I.
export & import ltd.

A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, New York

"Over 25 years experience in designing & building machinery"

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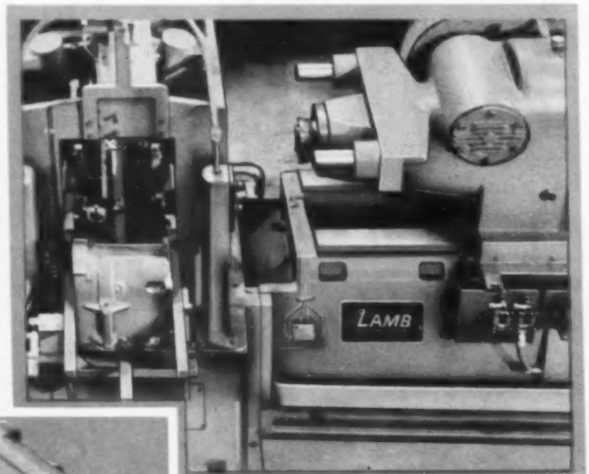
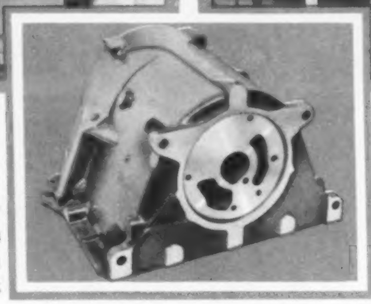
A Superior Transfer Machine .



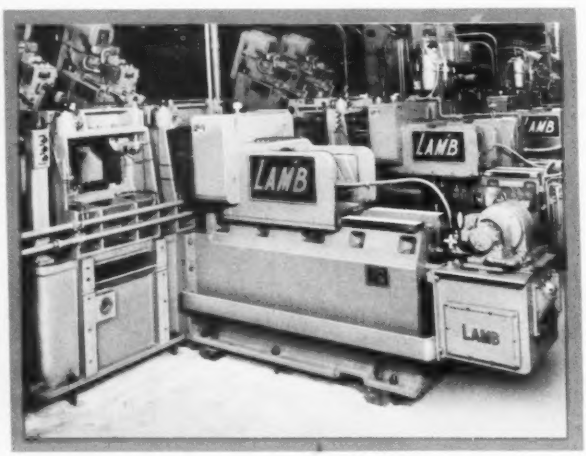


Part Moves Instead of Cutters

Two milling heads are solidly anchored to wing bases to absorb high cutter thrusts. A traversing fixture carries the securely clamped part between the cutters utilizing the movement of the transfer mechanism as the feed. Results: greater rigidity for better surface finish, longer cutter life, and shorter time cycle.

Plunge Facing of Intermittent Surface on Rough Casting

A rigid spindle plunge faces the rough casting with an inserted blade cutter. Two massive guide bars on work head enter into fixture guide bushings giving greater accuracy, better work finish, longer tool life, and permitting faster feeds and speeds.



No Floor Consoles

Operator's push buttons are sequence arranged at the first station of each section. Schematic pilot light arrangement on main control panel doors is visible from operator's position and indicates each station function or malfunction. Elimination of floor consoles saves space and simplifies electrical maintenance. All electrical controls and wiring conform to J.I.C. Standards.

Building-Block Construction Provides for Part Design Change

Standard main bases tie together the standard drilling and tapping units. Such interchangeable components provide the highest degree of machine flexibility for future part design changes. Hardened steel ways are standard construction. The individual standardized hydraulic power unit off the floor improves housekeeping.

. because of LAMB'S Knowledge of Manufacturing Methods

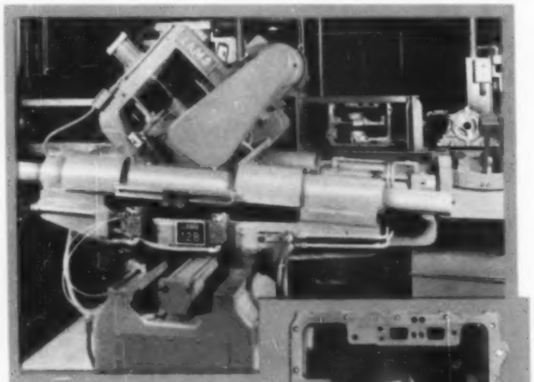
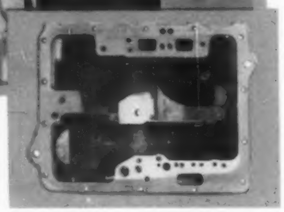
Broad experience in modern manufacturing methods that assures understanding of the customer's problems is an important characteristic of the LAMB organization. They also have the engineering ingenuity to solve these problems in a logical and economical manner. Illustrated and described on these pages are a few of the reasons why your next machine should have the LAMB name plate. It will mean higher production, lower unit cost, less down time, greater accuracy and uniformity, simplified maintenance, service accessibility, and minimized obsolescence. Submit your manufacturing problems for complete analysis today.

Transmission Case Completely Machined

Production is 128 pieces per hour at 100% efficiency. There are 112 stations for 237 machining operations, 128 hole probes with operations performed in five part positions. Parts are successively rough milled, bored and faced in the first section of the machine. Drilling, reaming, tapping, chamfering, counterboring, countersinking, spot facing and trepanning are completed in sections two, three and four. In the fifth section, the semifinish bore and counterbore, and finish profile mill operations are performed.

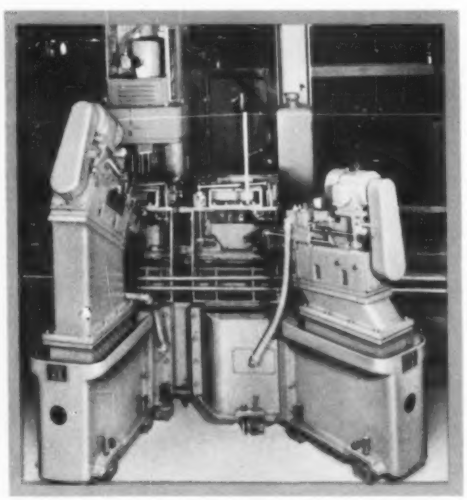
LAMB CREATIVE ENGINEERING AND COST-CONSCIOUS DESIGN

MORE EVIDENCE OF LAMB ENGINEERING FOR MANUFACTURING AND MAINTENANCE ECONOMY

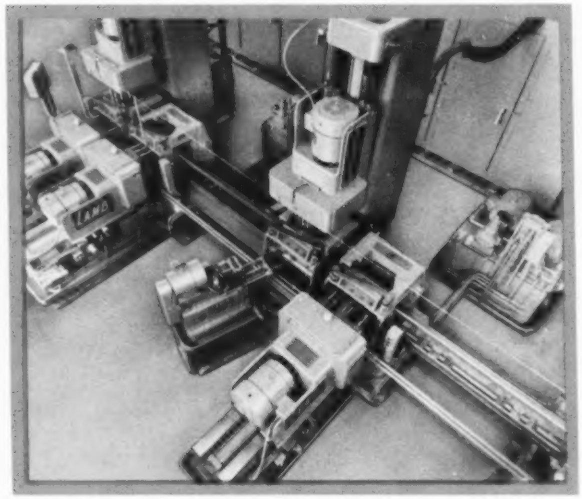
Profile Milling for Oil-Tight Precision Finish

Lamb ingenuity provides the method for precision end-milling the part's critical mounting faces. A constant feed rate is maintained over a 90° change in direction while cutting two surfaces parallel within .001 in 8 inches. The compound spindle carriage moves horizontally and vertically on pre-loaded linear ball bearings eliminating all carriage play.



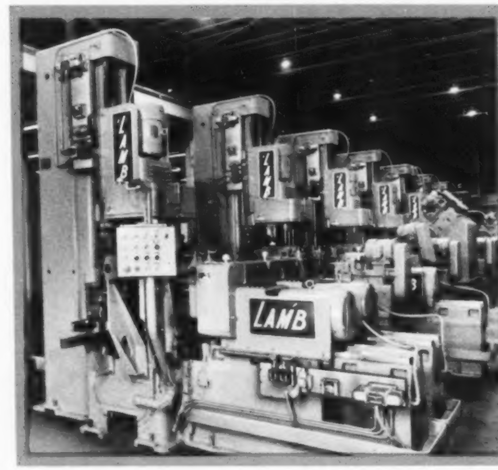
Standard Components

Standard quill type hydraulic units are mounted on standard wing bases. Height variations and angular approach to work are accomplished with simple angular spacers. A change in hole angularity requires only an inexpensive change of spacer. This "building-block" construction is applied to all units.



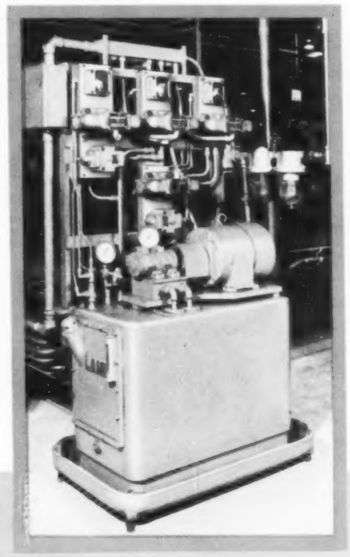
Greater Accessibility

Optimum utilization of each machining unit allows wider spacing without excessive floor area. This "open" arrangement affords greater accessibility for tool change, adjustments and maintenance. For part design changes additional machining and/or inspection equipment usually can be accommodated.



Hydraulic Manifolding Reduces Piping and Maintenance

Hydraulic manifolds with gasket mounted valves minimize piping and the possibility of leakage. Maintenance is simplified as the hydraulic controls are readily accessible and easy to replace without disturbing the piping.



"Packaged" Hydraulic Power Units Simplify Service

Hydraulic power units are built to J.I.C. Standards with components made by leading manufacturers. Motors, pumps, valves, fittings, etc., are selected to assist users in minimizing inventory of replacement parts and for service familiarity of maintenance departments.

New Plant And Offices This modern plant, designed for special machine manufacturing, houses men and machines selected to provide the finest in automated production equipment.

F. JOS. LAMB CO.

SINCE 1914

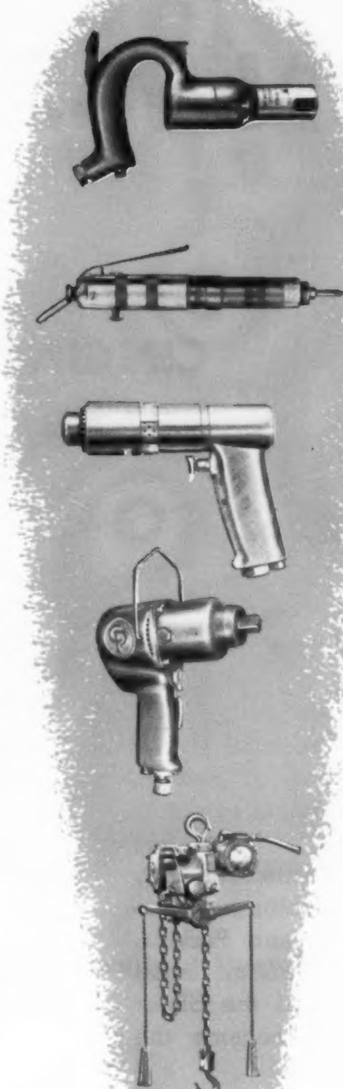
5663 E. NINE MILE ROAD • DETROIT 34, MICHIGAN

Engineers and Builders of Special Machines and Automation Equipment

Litho in U.S.A.

7953

if you GRIND, DRILL, DRIVE, CHIP, LIFT or BOLT



Chippers and Scalers—Start smoothly, hold easily, have fine throttling control.

Screwdrivers—Reversible and non-reversible types to drive any size threaded fastener to ¼". "One-Shot" clutches assure proper fastener tightness.

Drills—Reversible and non-reversible in straight or angle models to 3" capacity.

Impact Wrenches—Forty-one models available. Capacities to 1¾" bolt size.

Hoists—300, 500, 700, 1000 pound capacities. Pull chain control or remote control available.

Grinders—High torque air grinders in straight, angle and die grinder models. Sanders and wire brush machines also available.

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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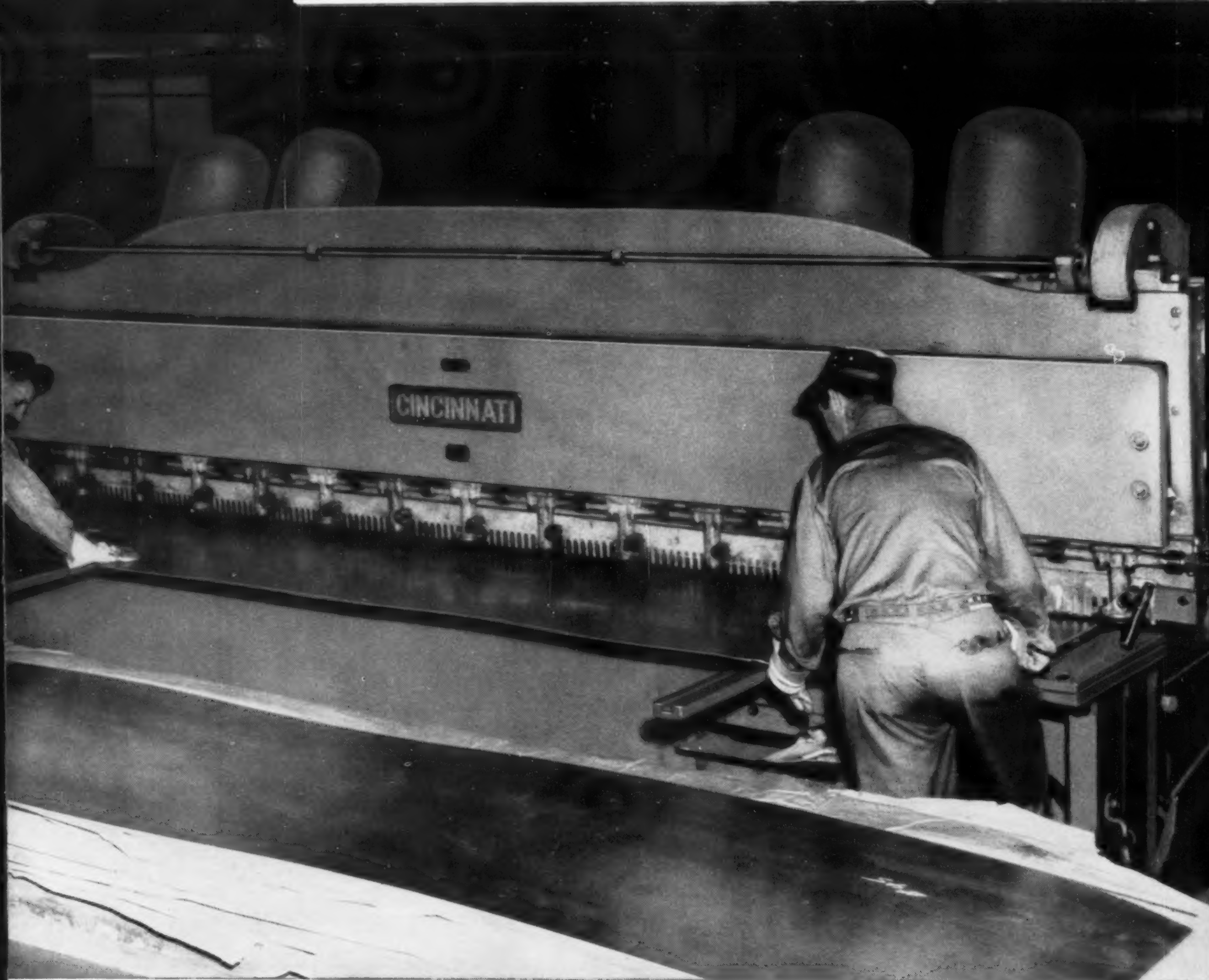
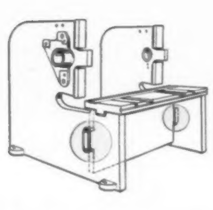
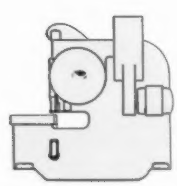


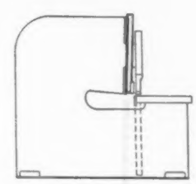
Some Important Standard Features



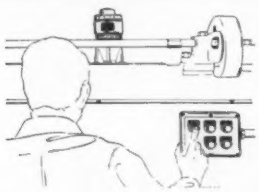
Interlocked construction means no welds used as load supports



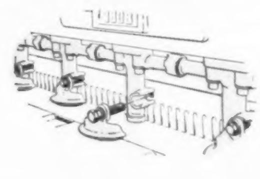
G a p frames allow shearing pieces longer than the machine



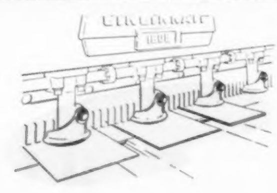
Inclined ram offsets the thrust caused by shearing action.



Front-controlled power back gauge is accurate, fast, convenient.



Hydraulic holdowns exert tons of pressure, insure accuracy.



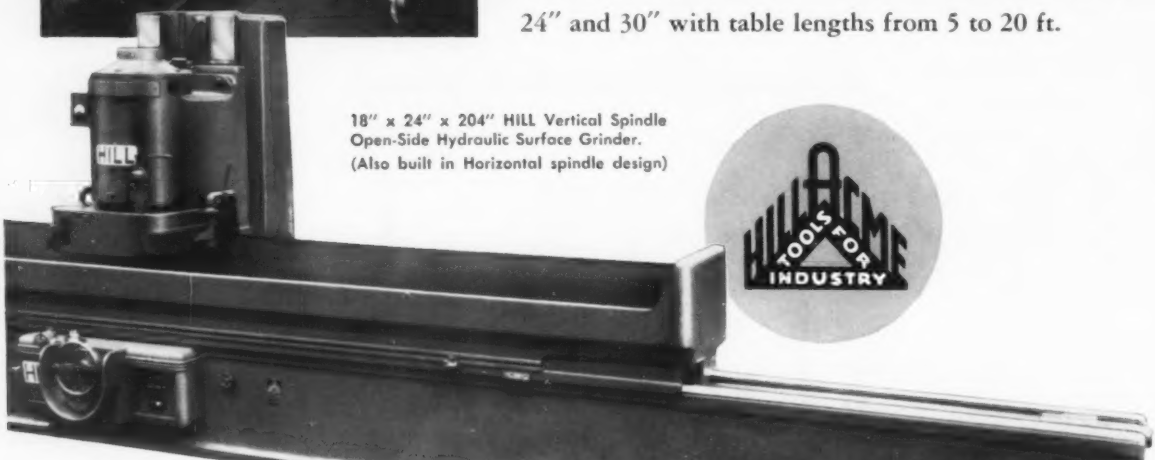
Different gauges, held with same tonnage, can be cut together.

EVERY HEAVY DUTY SURFACE GRINDER SHOULD HAVE:

- *Open-side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Controls*
- *Low Pressure Hydraulic System*
- *One-Shot Lubrication System*
- *Adequate Safety Devices*

BUT THEY DON'T—

So GET A HILL with ALL the above features *plus* many other design improvements which insure rapid stock removal and accurate grinding of flat surfaces within the periphery of the grinding wheel. HILL Vertical Spindle grinders are built in table widths of 18", 24" and 30" with table lengths from 5 to 20 ft.



18" x 24" x 204" HILL Vertical Spindle Open-Side Hydraulic Surface Grinder. (Also built in Horizontal spindle design)

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

1201 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING, TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

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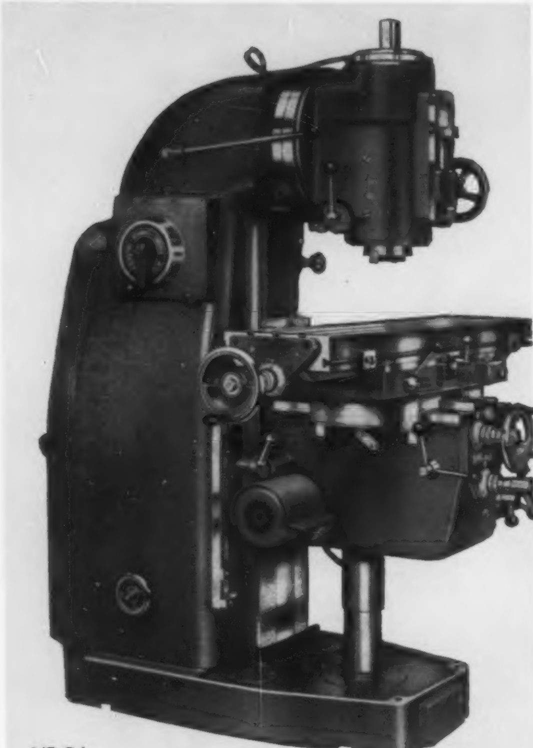


VF-54

ONLY SWEDISH CRAFTSMEN

Can Build These Precision Millers At Such Surprisingly Low Cost

HORIZONTAL AND VERTICAL SAJO MILLERS

Built to U.S. Standards, Sajo Millers with proven production records in modern industry are available in both plain and universal models. Installation references in your vicinity on request.

Standard Duty #2 (Model 54) ALL GEARED Millers—

Plain, Universal and Vertical—table 52" x 11", 7½ HP with power feeds (longitudinal 33½") and power rapid traverse.

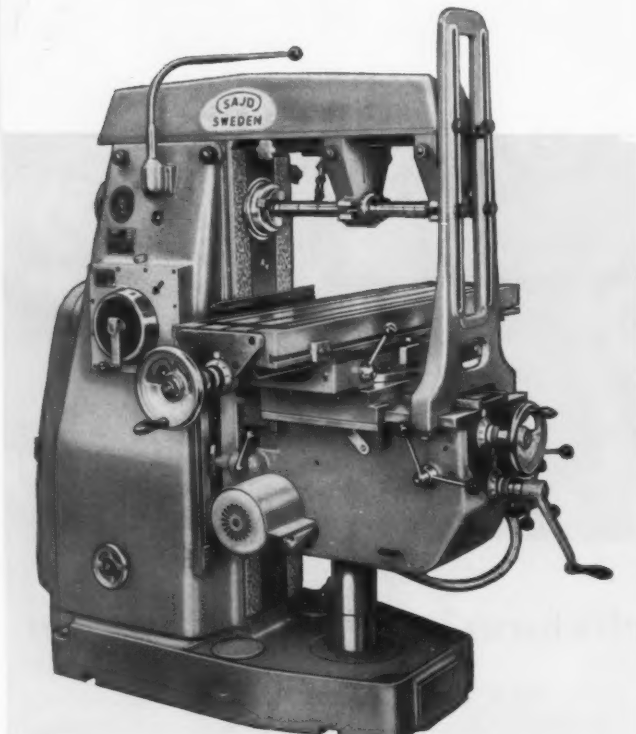
•

Light Duty #2 (Model 53) ALL GEARED Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

Light Duty #2 (Model 48) Utility Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").



PF-54

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76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

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HORIZONTAL AND VERTICAL SHAPERS • POWER HACKSAWS

FAST SERVICE AND PARTS AVAILABLE FROM MAJOR CITIES, WRITE FOR CATALOGS

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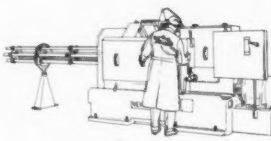
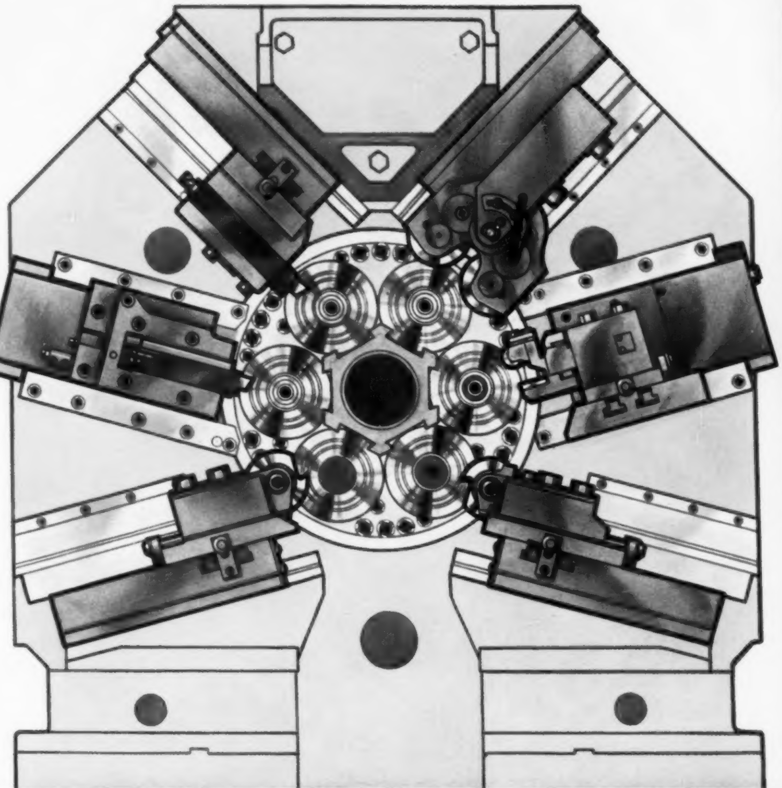
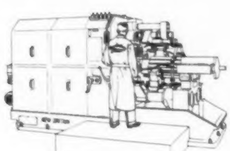
Look at New Britain's
new cross slide arrangement



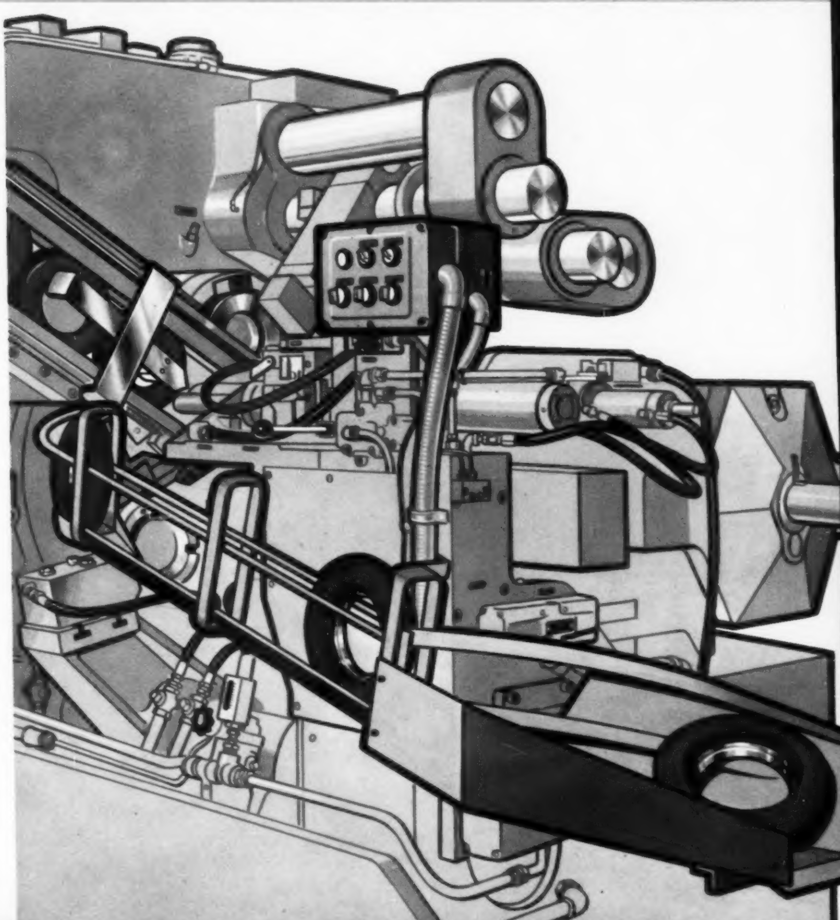
Independent radial cross slides in *all* positions, providing maximum clearance for more cross slide operations.

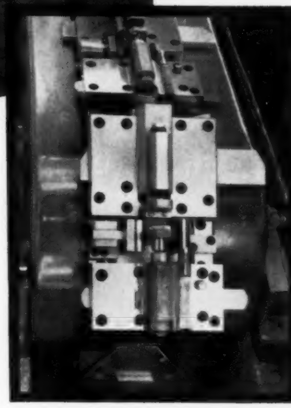


Look at New Britain's
open-end chucker design



Greater accessibility for all applications and particularly well adapted to automatic handling of pieces. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

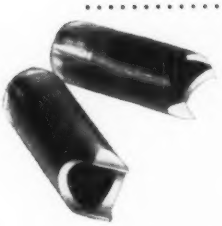




Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.

LOWER COST . . . PER PIECE WITH SURFACE BROACHING OF SMALL PARTS

In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching, in many fields.



THE FOOTE-BURT COMPANY
Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

ENGINEERED FOR PRODUCTION

Write for Circular No. 503

FOOTBURT

PIONEERS IN SURFACE BROACHING

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BUHR

a world's leading manufacturer of multiple-spindle high production machinery like this...

the record...

Since 1912, Buhr has grown steadily to its present position as a world leader in the manufacture of special automation machinery.

Wherever special metal-working machinery is purchased, BUHR ECONOMATICS are well-known for Quality and Performance.

BUHR MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

BUHR ECONOMATIC

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Allen-Bradley Line
of MOTOR CONTROL
includes Both!

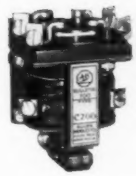
D.C. — A.C.

RELAYS AND CONTACTORS

Bulletin 200, Type G Relay. Rated: 5 amp, 64 v; 2 amp, 125 v; 0.5 amp, 250 v.

Bulletin 202 Contactor, Size 2, 1 Pole. Rated: 50 amp, 115-230 v.

D.C. relays are made with up to 8 poles. Also universal types, having contacts changeable from N.O. to N.C.—or vice versa—by merely reconnecting the terminals. Up to and including the 150 ampere rating, D.C. contactors are of the solenoid type; beyond this rating, up to and including 600 amperes, the clapper type construction is used.

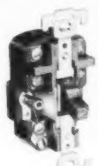


Bulletin 700, Type C. Rated: 10 amp, 550 v max.

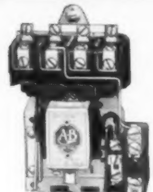
Bulletin 702, Size 2, 3 Pole. Rated: 50 amp, 550 v max.

A.C. relays are made in different types for various applications, with up to 8 poles. The universal type, having contacts changeable from N.O. to N.C.—or vice versa—is very popular. The A.C. solenoid contactors, made in 9 ratings up to 900 amp, 550 v max., will satisfy any service requirement. Silver alloy contacts are used throughout the D.C.-A.C. solenoid relay and contactor lines.

ACROSS-THE-LINE STARTERS



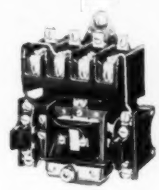
Bulletin 600, Form 52, double pole only, open type. Max rating: ¾ hp, 115-230 v.



Bulletin 209, Form 2. Max rating: 1½ hp, 115 v; 2 hp, 230 v.

D.C. manual starters have a rugged, snap action mechanism that prevents contact "teasing" and thus prolongs contact life. D.C. manual and solenoid starters have maintenance free, double break, silver alloy contacts. Motor overload protection is reliable.

Bulletin 600 in general purpose enclosure, complete with reliable overload breaker. Rated: 1 hp, 110-220 v.

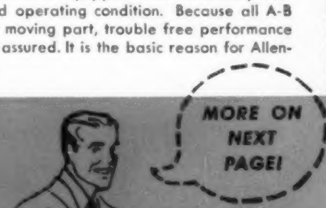


Bulletin 709, Size 1. Rated: 7½ hp, 220 v; 10 hp, 440-550 v. Same general construction for max ratings of 300 hp, 220 v; 600 hp, 440-550 v.

All Allen-Bradley A.C. motor control is equipped with silver alloy contacts which are always in good operating condition. Because all A-B solenoid starters have only one moving part, trouble free performance and long life are automatically assured. It is the basic reason for Allen-Bradley's "quality" reputation.

A-B QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



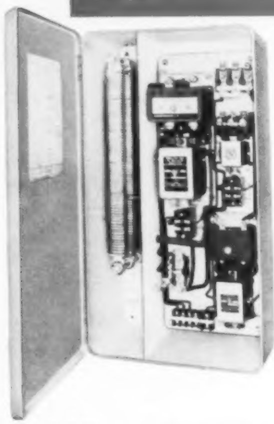
13-57-MR

...and more

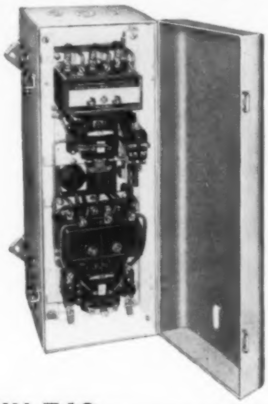
Allen-Bradley MOTOR CONTROL

D.C. A.C.

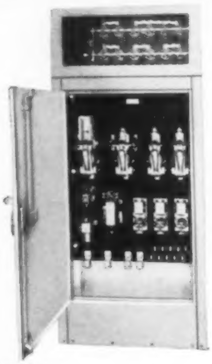
REDUCED VOLTAGE STARTERS



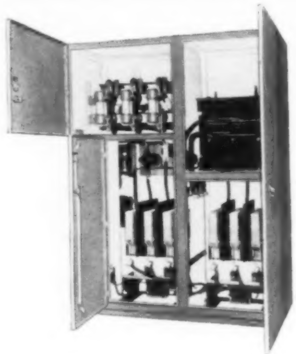
BULLETIN 267 are time limit, resistor type starters for automatic acceleration of constant speed shunt and compound wound D.C. motors. Solenoid contactors used up to and including Size 4 ratings. Max ratings: 75 hp, 115 v; 150 hp, 230 v.



BULLETIN 740 are graphite resistor type starters for automatic acceleration of squirrel cage A.C. motors. Made with 1 or 2 points of acceleration. Can provide velvet smooth acceleration for squirrel cage motors. Max ratings: 200 hp, 220-440-550 v.



BULLETIN 268 are time limit resistor type starters for automatic acceleration of adjustable speed shunt and compound wound D.C. motors. Designed for heavy duty service. Both Bulletin 267 and 268 starters available with or without dynamic braking feature, and also for reversing service. Max ratings: 75 hp, 115 v; 150 hp, 230 v.



BULLETIN 983 high tension starter illustrated above is of the reactor type, intended for starting synchronous motors. Available as an autotransformer reduced voltage starter; also in the across-the-line construction. The heavy duty, solenoid air break contactor assures long, trouble free life. Max ratings: 1500 hp, 2300 v; 2500 hp, 4600 v. at 0.8 P.F.

The Allen-Bradley *quality* line is *not* limited to alternating current motor control. A companion line of direct current motor control is available with the same outstanding *quality* . . . the same reliability . . . the same ability to "take it." Both lines are described and listed in our latest A-B Handy Catalog, and our trained field engineers will also be glad to help you with your control problems.

You cannot make a mistake when you insist on Allen-Bradley control.

A-B QUALITY

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

Allen-Bradley Co.
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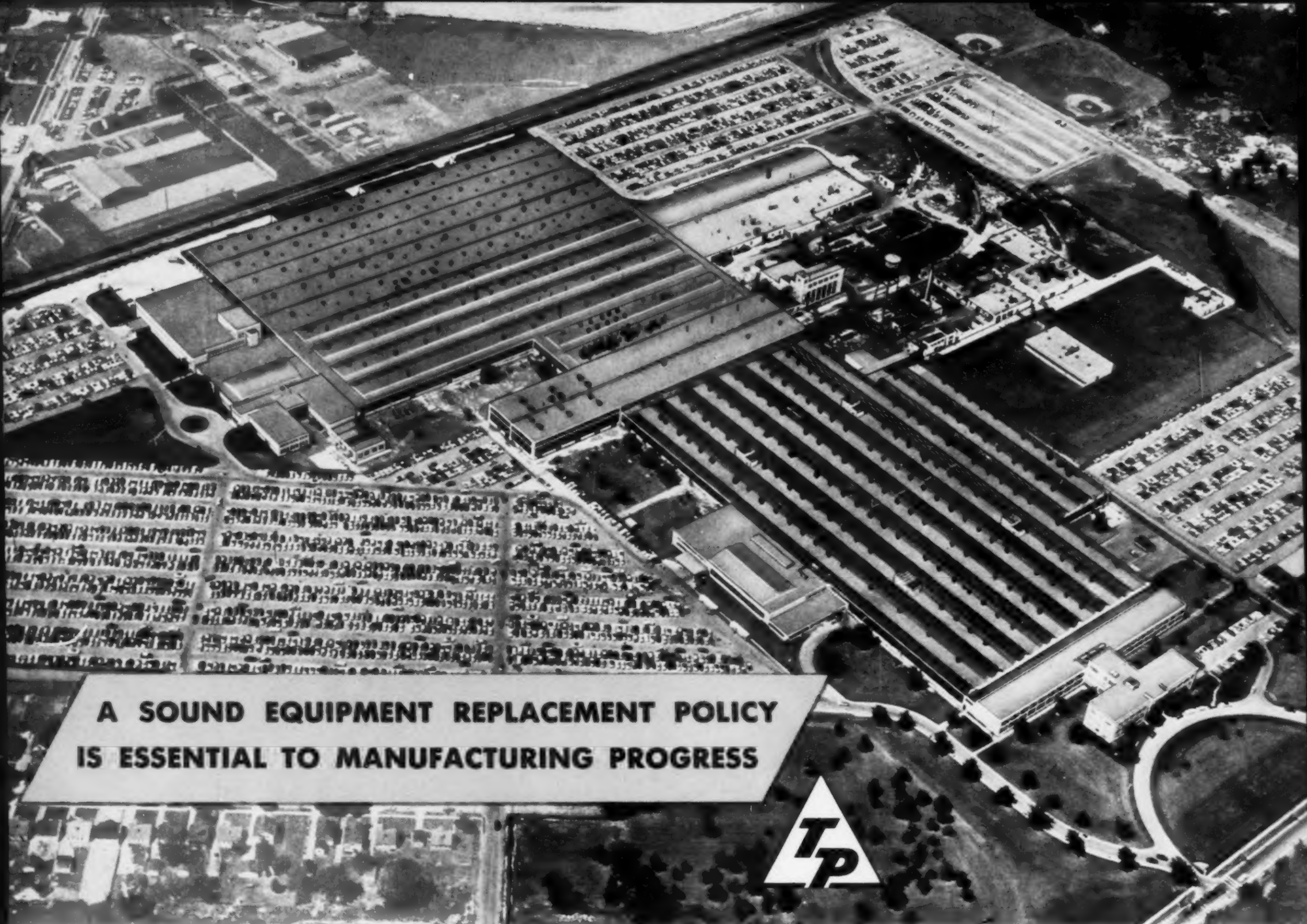


"TAPCO PLANT" THOMPSON PRODUCTS, INC., CLEVELAND, OHIO
MFRS. AUTOMOTIVE, AIRCRAFT, ELECTRONIC AND INDUSTRIAL PRODUCTS

"Modern management must base decisions on facts and figures, *not on hunches.* We at Thompson Products consider the proper administration of a capital expenditure program one of the prime responsibilities of management. Capital expenditure appropriation requests supported by engineering economy studies (MAPI type) and a make-good report after installation provide a sound basis for our decision."

J D Wright PRESIDENT
Thompson Products, Inc.

ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When You Replace Machinery...

ENGINEERING DATA → PUNCHED TAPE FOR EACH PART

specifications:

248 Operations—
drilling, spotfacing, chamfering

Capacity—
parts up to 36" O. D. x 30" long

Spindle Capacity—
drill ¼" to 1" in steel,
3" O.D. x No. 3 Morse Taper

Spindle Travel—
30", with max. speed of 60 ipm.

Spindle Head—
hydraulic cylinder actuated,
300 ipm. rapid approach,
speeds—as selected by tape
feeds—4-feed rates between 0.5 and 11 ipm.

Rotary Table—
40" O.D., 1½ HP motor

Tools—
13, quick-change type

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

new **BARNESDRIL** machine

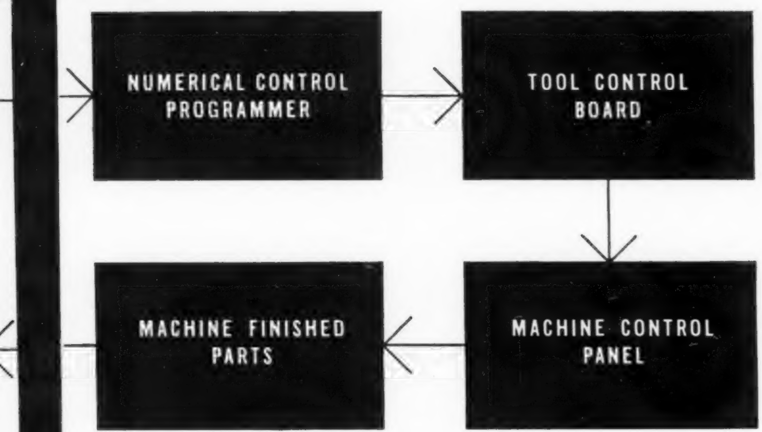
automatically programs 248 operations

on compressor housings

- **features numerical control by punched tape, unique tool control board**
- **reduces set-up, saves fixturing costs, assures accuracy**
- **solves high-volume, short-run production**

This new BarnesdriL programming machine automatically performs a preselected pattern of operations for machining gas turbine compressor housings, from information stored on standard, business-machine type, punched tape. The pattern is changed at will by substituting a different tape, and the pattern applies to single or multiple plane operations.

A specially designed tool control board integrates the machine programming with the proper sequence of cutting tools, so that the machine will not operate until the correct tool has been selected and placed in the machine, and all others returned after use to their proper places on the tool board. Tools are quick-change pre-set type, selected successively for drilling, boring, reaming, tapping, spotfacing and chamfering.



Information fed back from the machine's movements by means of selsyn motors maintains a constant check on the accuracy of positioning. In actual operation the machine cycles constantly within .003" for true positioning tolerance. Repeatability accuracy is within .001".

With program-type machining, BarnesdriL engineers provide automatically-selected spindle speeds in sequence, according to the best machining practice for the particular operation and kind of material. Feed rates are also programmed to meet the requirements of the part design and machining operation.

Flexibility in type, number and position of operations is obtained by substitution of separate tapes for individual parts to be machined. As a result substantial savings are realized in set-up time and fixturing costs. These are important advantages in high-output, short-run production. Also, with the flexibility inherent in program-machining, the need is eliminated for stock-piling parts.

your inquiries are invited!

BarnesdriL engineers invite your questions and inquiries in connection with production savings involved in program machining for high-output, short-run parts. Send parts or drawings for estimates, or request an engineer to call and discuss these problems in your plant!

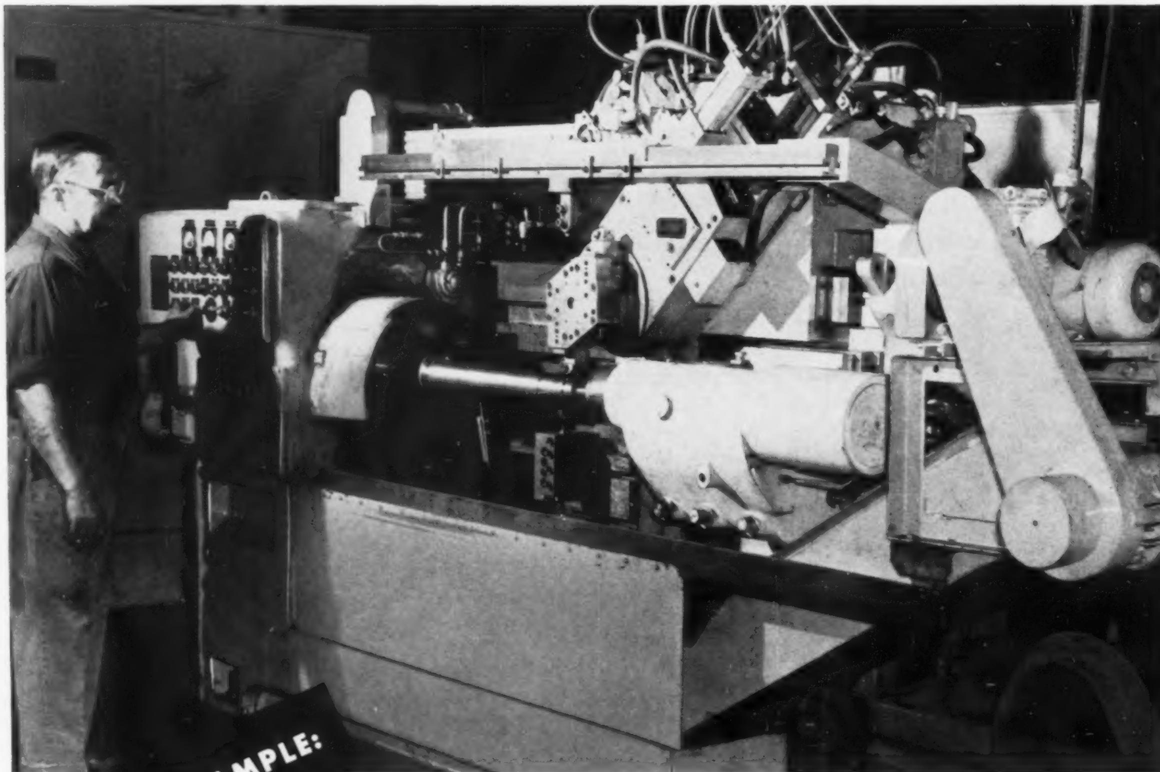
50th year

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Before you buy any turning equipment see what you get from SUNDSTRAND



FOR EXAMPLE:

This SUNDSTRAND Tracer Lathe simplified operation, reduced costs and improved accuracy and finish!

This one Sundstrand Automatic Tracer Lathe installed at International Harvester's Tractor Works replaced two lathes previously required for the turning of bevel pinion shafts. Increased production, reduced set up time, closer tolerances, simplified operation, reduced costs, and finer finishes are the benefits of this change to Sundstrand.

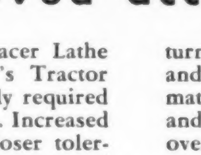
Changeover time was reduced from an average of 8 hours to 1 hour on the multiple small lots turned on this lathe. Rough forgings are ruff and finish turned in one set up using an automatic indexing tool turret equipped with a ruff and finishing tool. Finishes were improved 50% over previous machining method and tolerances are consistently held within the specified limits to eliminate rework.

All of these combined features add up to a production increase, reduced cost and overall simplified operation.

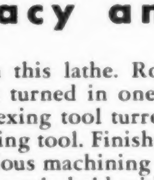
SUNDSTRAND "Engineered Production Service"*

*REG. U.S. PAT. OFF.

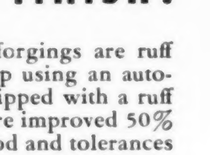
AUTOMATIC LATHES



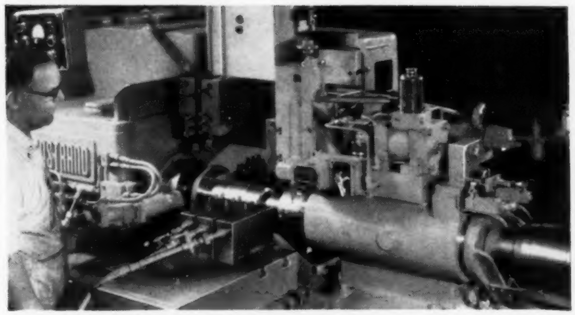
SIMPLEX RIGIDMILS



DUPLEX RIGIDMILS



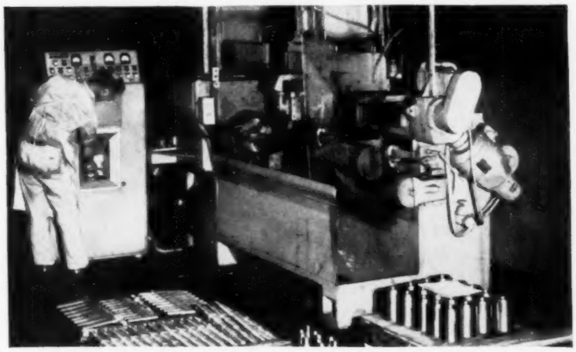
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



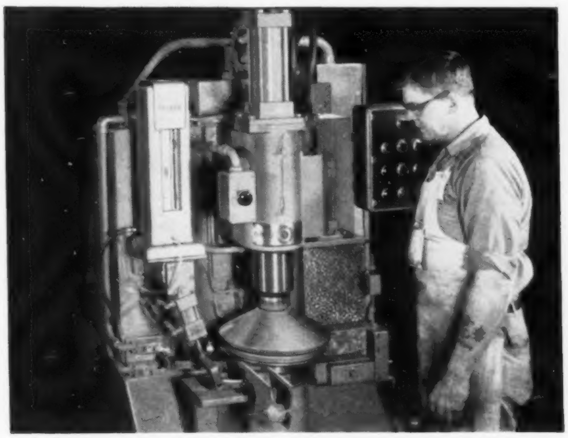
MULTIPLE TOOL TURNING—Where a variety of turning, boring, facing, and forming operations are required on a particular part, Sundstrand automatic lathes can be provided with a combination of tools mounted on front, rear, and overhead carriages, permitting the maximum number of surfaces to be machined in a short machine cycle.

SUNDSTRAND
"Engineered Production"
INCREASES EFFICIENCY

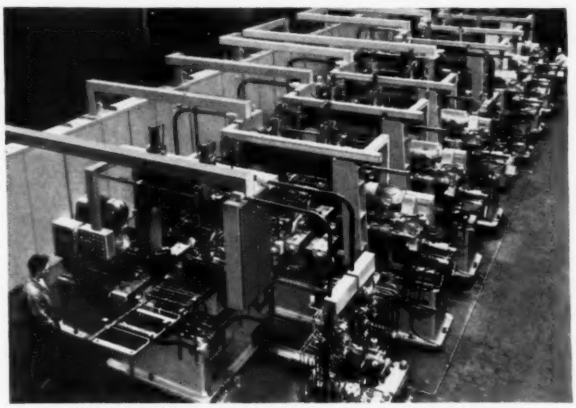
. . . because the choice of the processing method—including the machine and tooling—is based on years of experience in solving every type of machining problem. Because Sundstrand builds a complete range of tracer, multiple tool, vertical and special lathes as shown on these pages, you will obtain the *best machine for your specific needs,* one that includes advanced design ideas for outstanding turning efficiency.



PUNCH CARD CONTROL—A few of the parts being turned on this punch card controlled automatic lathe are visible in foreground. Both setup time and mechanical skill requirements are held to a minimum with this machine while high-quality work is assured.



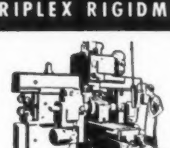
VERTICAL TURNING—This Sundstrand vertical automatic production lathe is basically a standard machine with platens for mounting turning or grooving slides, multiple tool slides, or tracer slides. Floor space requirements are reduced materially, and automatic handling can be applied readily. One operator can readily handle several of these machines.

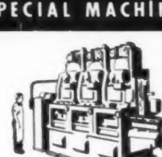


SPECIAL TURNING—Where production requirements are high, Sundstrand special automatic loading process lathe lines, like this one for automotive camshafts, insure high output of top quality work. The part goes through the complete line without any manual handling whatsoever.

More facts about Sundstrand turning equipment are available in Bulletin 686 Write for your copy today.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

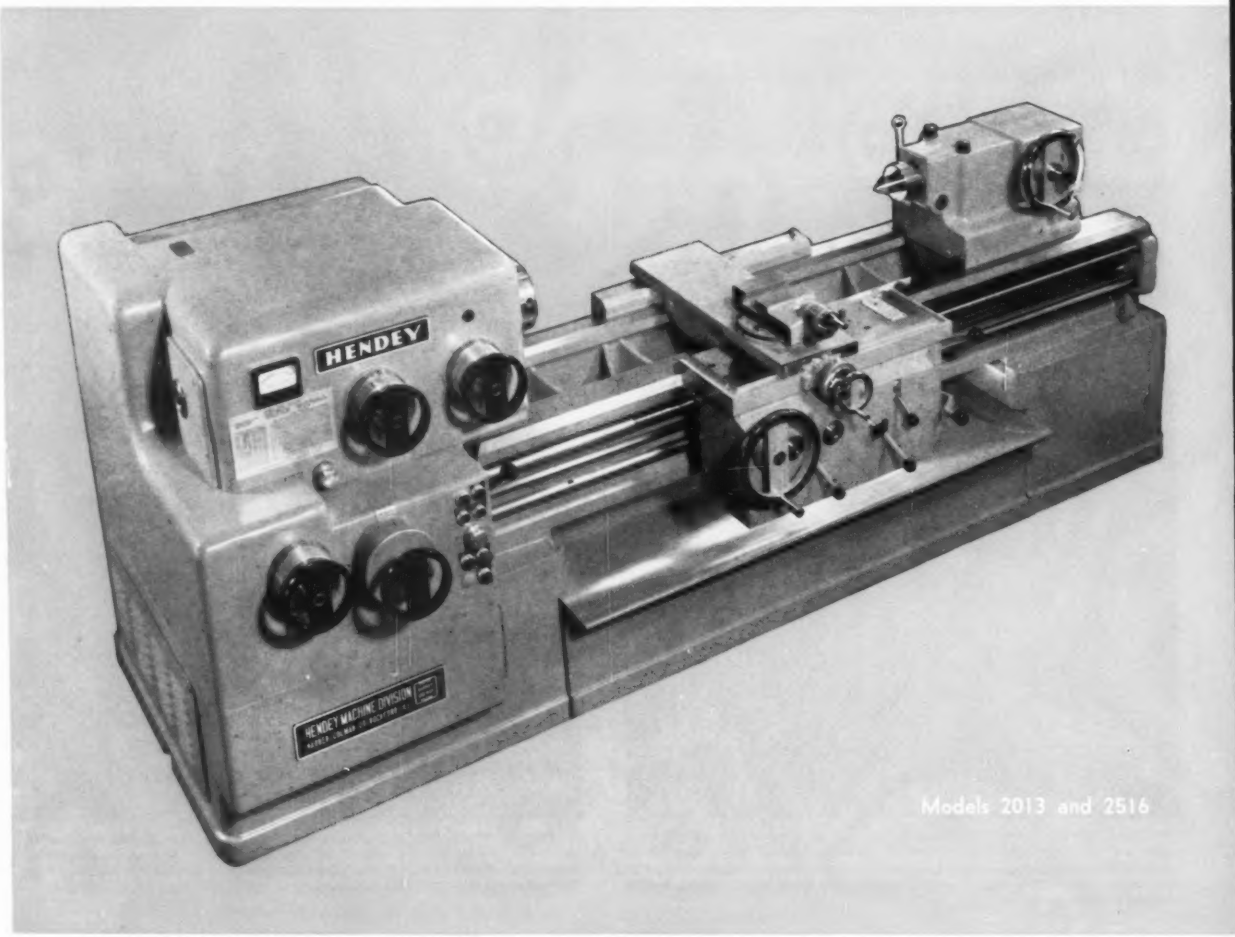




SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

BARBER-COLMAN offers new *Hendey* 32-speed



More rigidity, more threading features, more lathe per dollar!

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

geared-head lathes

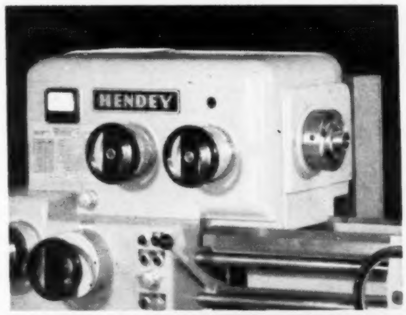
Here are the all-new Hendey No. 2013 and No. 2516 lathes, with a 32-speed geared head (up to 2000 rpm), a complete line-up of threading features, and heavy-duty design combined with toolroom precision. The 32-speed headstock transmission contains crowned, flame-hardened spur gears which are automatically lubricated. You select speeds simply by shifting gears. Greatly simplified mechanical design gives you lower maintenance costs — more machine, dollar for dollar, than any other lathe in its class.

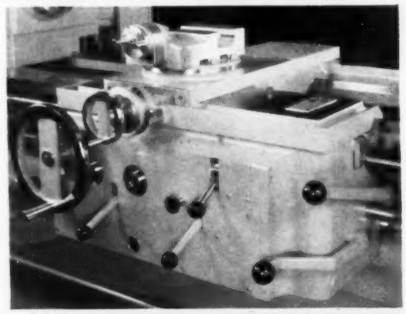
Three sets of super-precision tapered roller bearings support the spindle at both ends and in the middle, increasing accuracy and improving finish. An automatic spindle adjuster eliminates any manual adjustment of the spindle bearings regardless of the spindle speed.

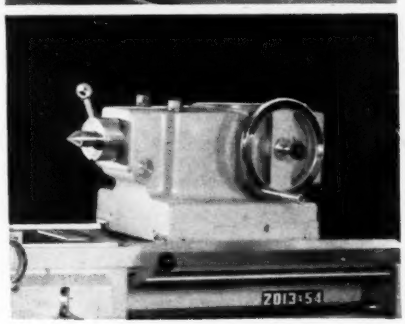
The extra-heavy bed casting is made of dense, wear-resistant semi-steel, which is induction-hardened and ground on all way surfaces. Lathes can be furnished with a 15, 20, or 25 hp spindle drive motor and come equipped with a load meter and automatic overload release for the carriage feed.

Hendey has all the threading features, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 feed and thread changes, with 2 to 120 quick-change threads per inch and feed range from .0015 in. to .091 in. per revolution, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to the half nuts.

Compare these tailstock features with other lathes on the market: Weighing almost 400 lb, the tailstock can be positioned quickly and easily with one hand. And the ways under it are hardened and ground. Large 4½ in. diameter spindle has a full 10 in. extension, with slow and rapid traverse speeds.



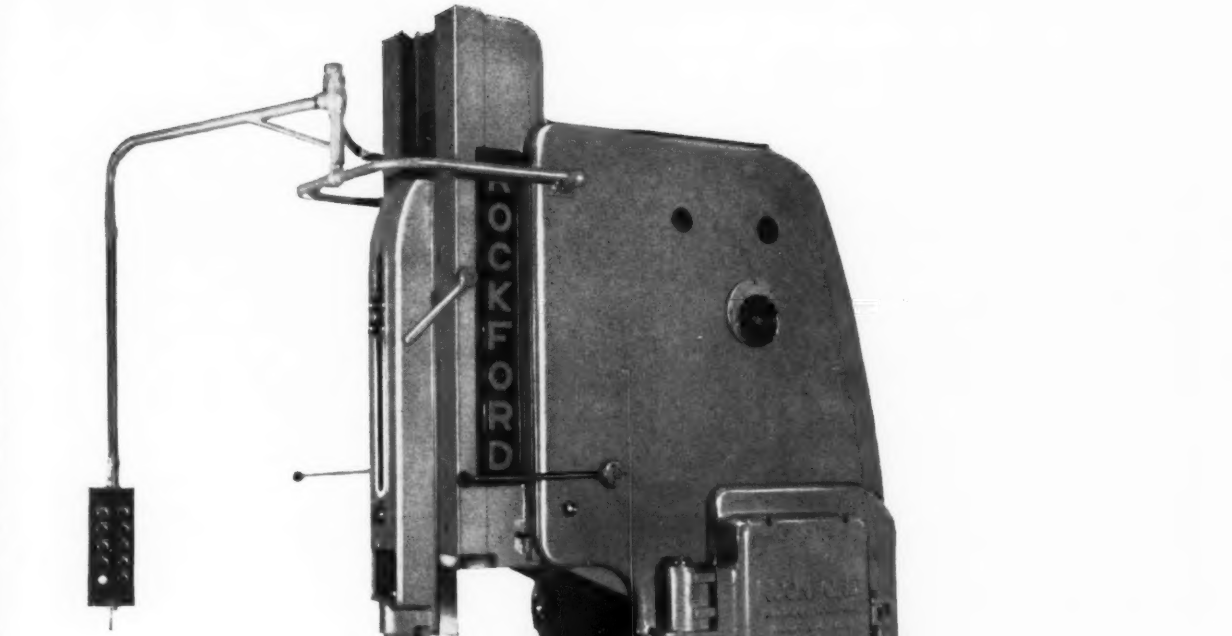




Hendey machine division
BARBER-COLMAN COMPANY
122 Loomis St., Rockford, Illinois

BARBER COLMAN ®

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



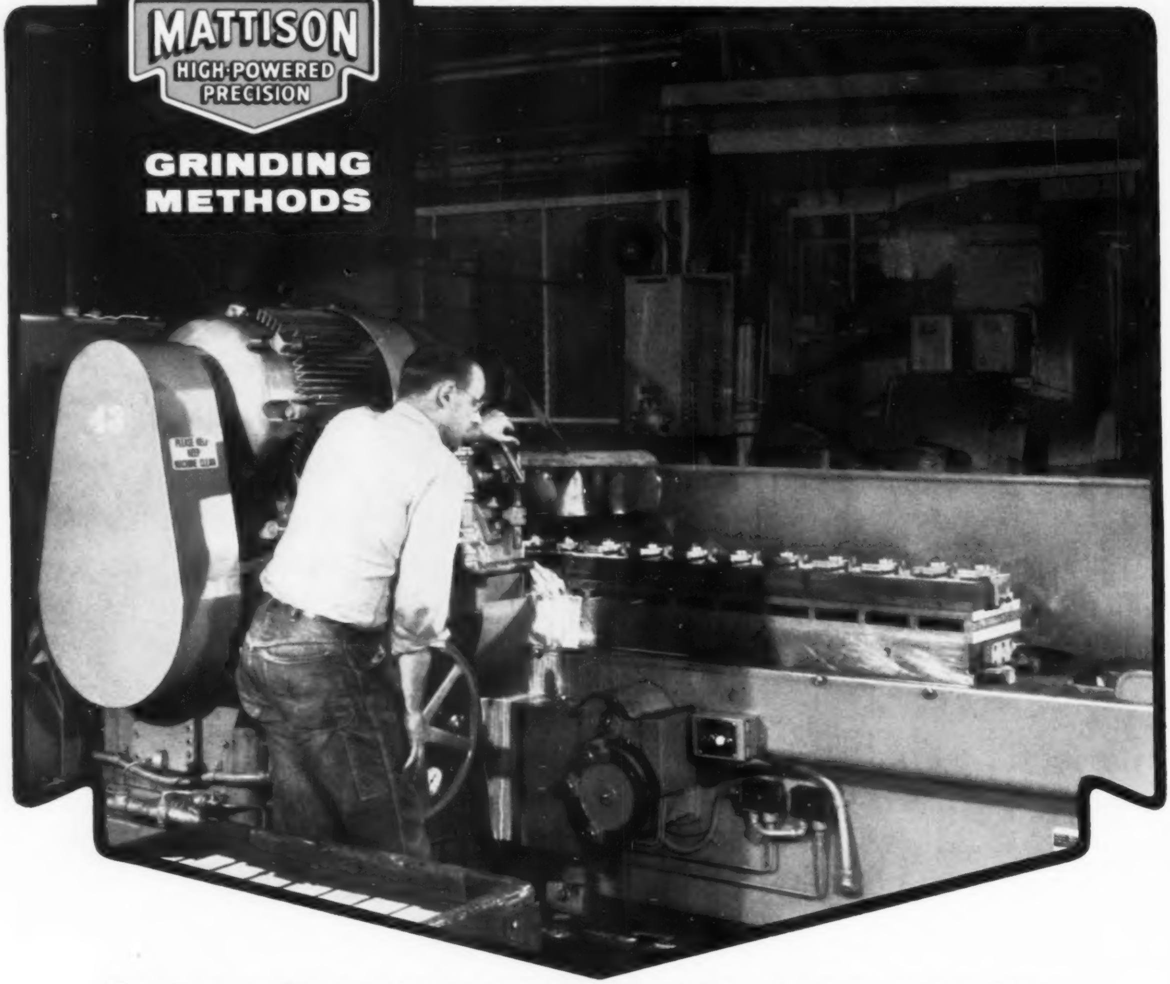
ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



Increasing stock removal by face grinding boosts production 26% . . . rejects eliminated!

Tough steel tamper bars, up to 15 in. long, are ground flat within .005 in. Hardness is 54-57 Rockwell (C).

Greater contact area of the segmented wheel, backed up by rigidity and high horsepower of the Mattison No. 4000 hydraulic-feed face grinder, produced valuable production benefits in grinding tamper bars at the Barber-Greene Company, Aurora, Illinois.

The tough steel bars must be ground within .005 in. for flatness. Production officials of the company say: "Our grinder takes a good, deep cut out of the bars and does it speedily, without overheating." Time-study figures compiled over a three-month period show the following production gains over the old method: 19% increase grinding both ends; 29% increase grinding edges; and 30% increase grinding flats, an average of 26% gain in all operations on the "Mattison."

If you are doing a production machining job by milling, planing, shaping, or peripheral grinding, a Mattison face grinder or vertical spindle surface grinder probably can help you improve quality and reduce costs.

At Barber-Greene, for example, each of the wheel segments offers *ten square inches* of grinding surface in actual contact with the work, permitting high stock removal and efficient coolant distribution for fast grinding with minimum heat generation. Your Mattison dealer can arrange to have your parts test-ground in the Mattison Methods Laboratory.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

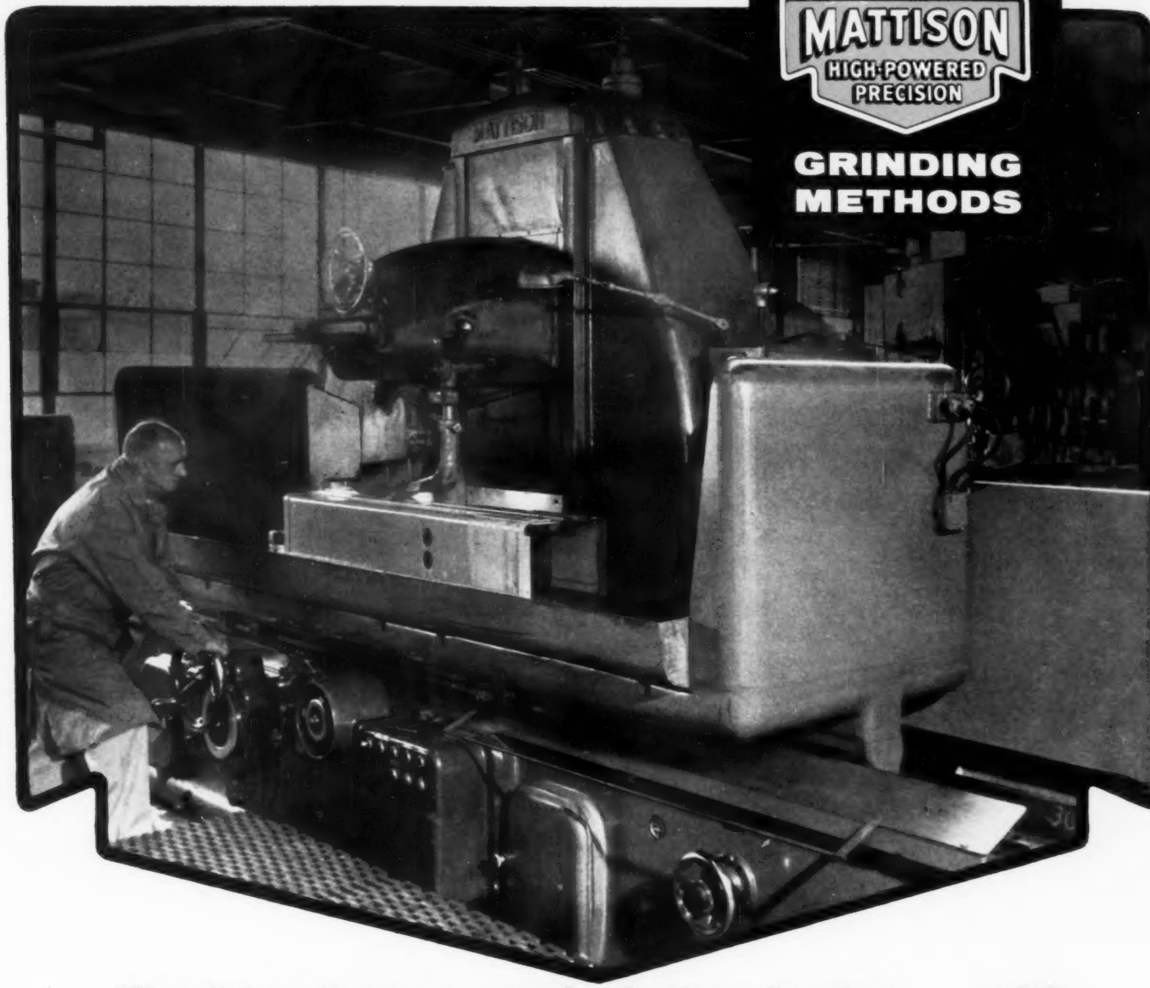
HIGH-POWERED PRECISION SURFACE GRINDERS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 43—FABRICATED MACHINE BASES

MATTISON HIGH-POWERED PRECISION

GRINDING METHODS

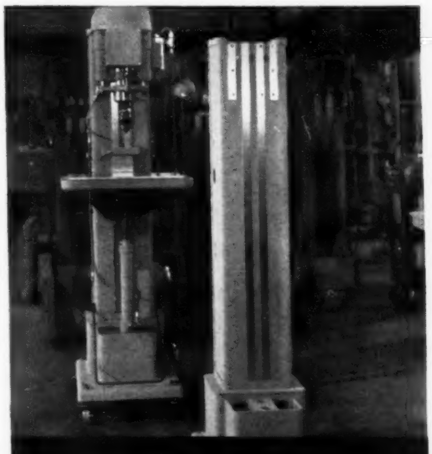


Machine bases made faster, better . . . with switch to steel fabrication and surface grinding!

"Following the installation of our Mattison surface grinder two years ago, we were able to accelerate production by 100%, improve accuracy, reduce wheel dressing by 700%, facilitate assembly, maintain consistently better finish, increase wheel width, achieve positive cooling, eliminate chatter, and retain our tool quality without price increases to our customers," says Mr. Herman Goldberg, president of the Snow Manufacturing Company, Bellwood, Illinois.

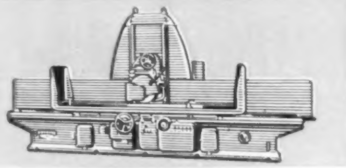
Installation of the grinder was part of a program which involved switching from cast iron to fabricated steel machine bases and replacement of milling with surface grinding. Now, this company is converted to steel fabrication and precision grinding in 98% of its machine construction, with improvements in productivity and quality.

Vitally important to precision of this company's line of single- and multiple-spindle precision drilling and tapping machines is accurate machining of the 59-inch-long channels on the vertical main frames shown at the right. All surfaces on the frames are now ground on the Mattison to limits of plus or minus .005 in., and flatness is held to .0015 in. over the entire length of the channels. Vise jaws for fixtures are held to within .0003 in., and parallelism of dovetail assemblies is held to .0005 in. over a 38-inch length.



Flatness of 59-inch-long channels is held to .0015-inch over entire length.

If it's a flat surface, there's a Mattison to grind it!



FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

"Engineered Production" Service

FOR BROACHING

SUNDSTRAND

It takes all 3

American's "Engineered Production" Service . . . gives the broach user the complete three part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

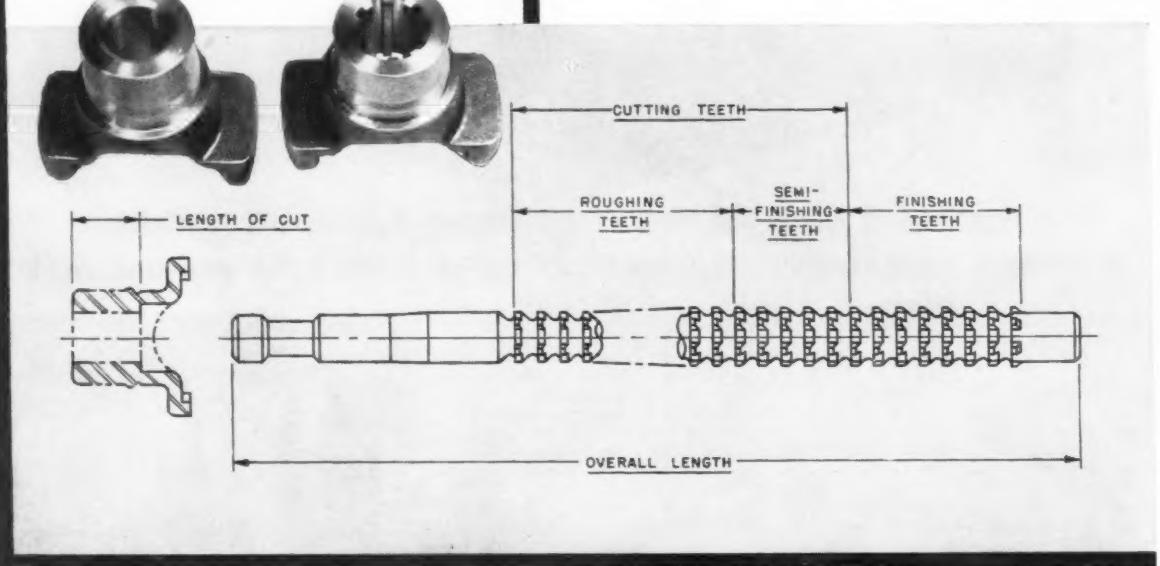
THE JOB — Broaching splines in two different end yoke parts — four at a time — with a high production rate required.

THE RESULT — 480 completed parts per hour in a semi-automatic cycle using manual loading and unloading.

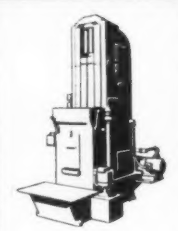
1

PROPER BROACH TOOL DESIGN

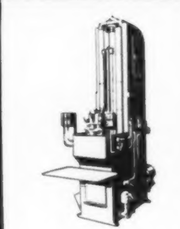
Top quality results on any broaching operation require starting the job with design of the broaching tool. In solving this all important first step, American Broach considers stock removal, length and width of cut, finish, tolerances required, etc. Because the broach and machine are designed to operate as a team, high quality work and long tool life result. In this installation, radial location is maintained between the broach spline and the half round in the opposite end of the parts.



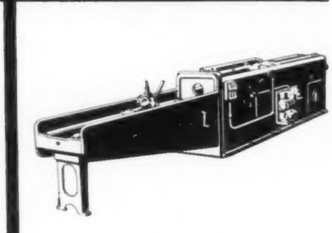
Broaching Tools



Three Way



Single Ram



Horizontal

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

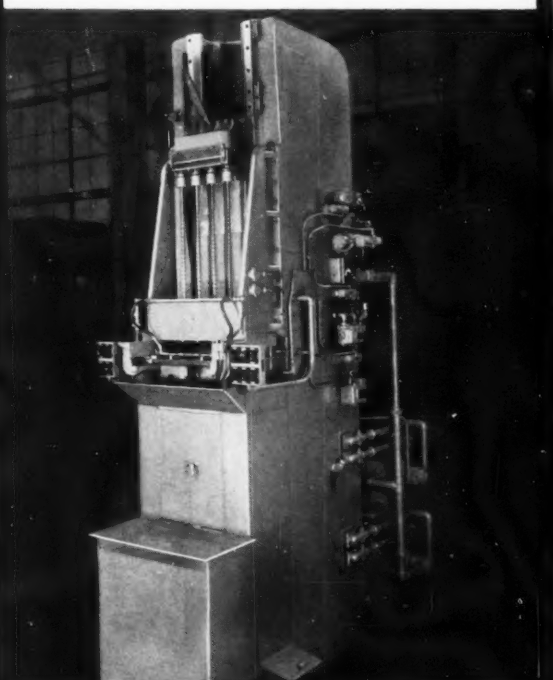
to give you peak broaching performance

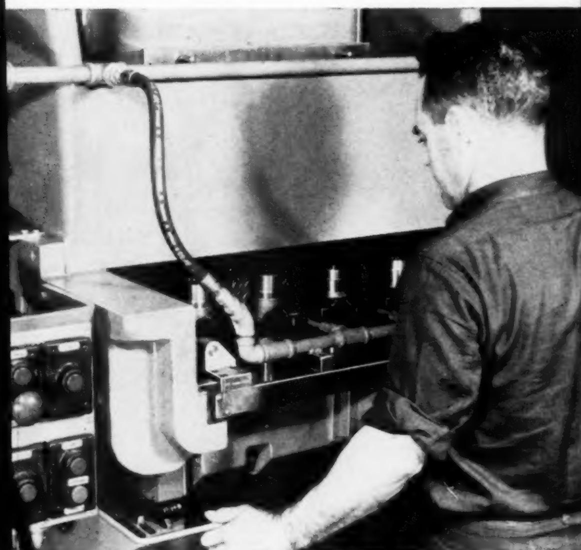
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc., determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. This vertical pull up, 40-ton, hydraulic broaching machine is provided with a variable broaching speed up to 16 feet per minute.

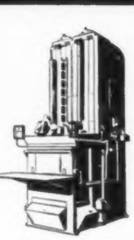
3 EFFICIENT FIXTURING

Whatever your parts geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. The operator unloads and reloads manually at the end of work stroke when work slide moves out with finished parts and broaches return to starting position. This installation again shows how American builds "skills" right into the tool, machine, and fixtures, enabling production schedules to be maintained even with inexperienced operators.

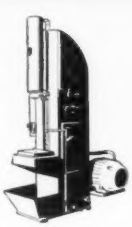




Write for American's Vertical Pull Up Bulletin A621 for more information on practical broaching methods by American.



Duplex Ram



Presses

American

SUNDSTRAND

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

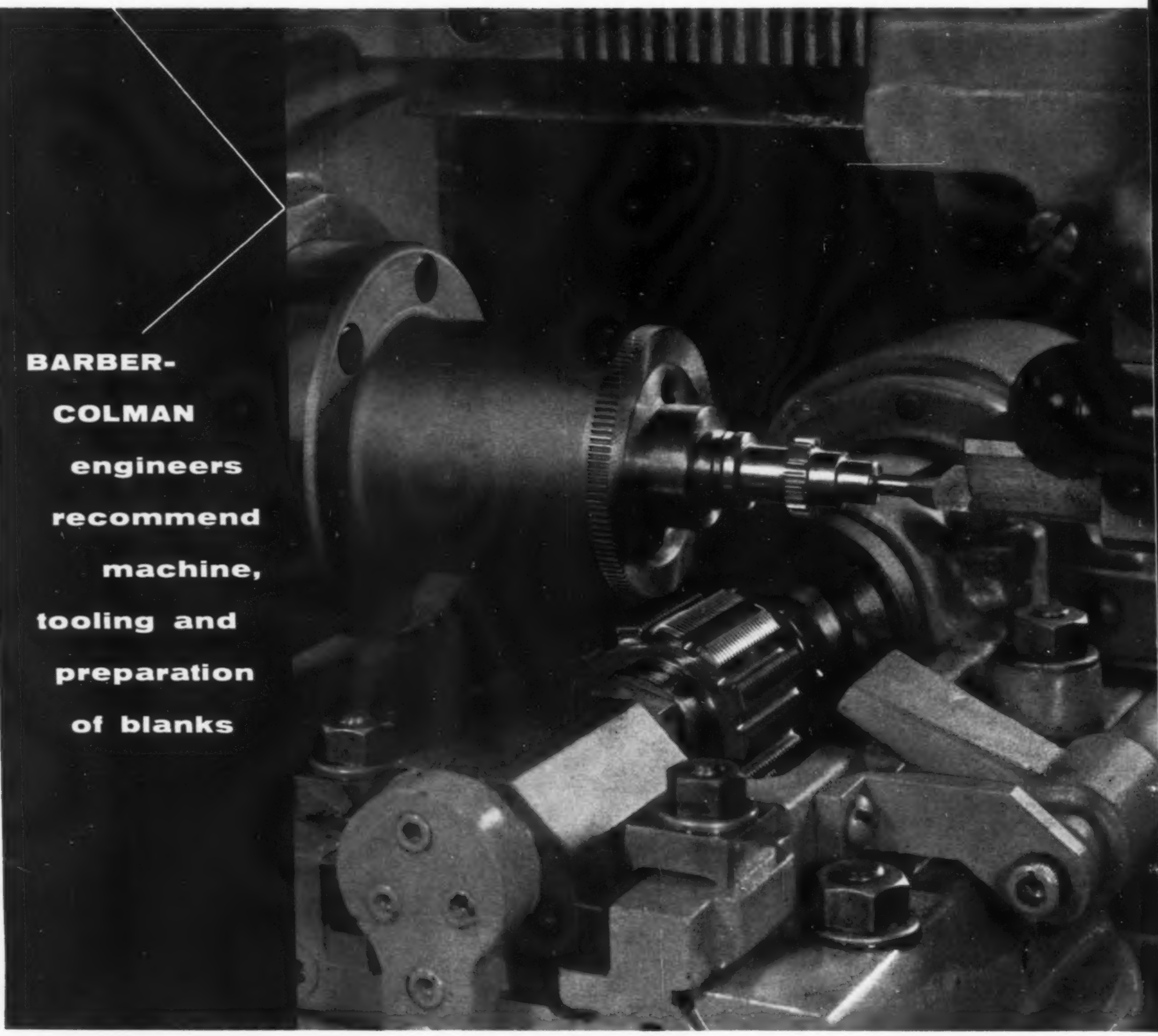
ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

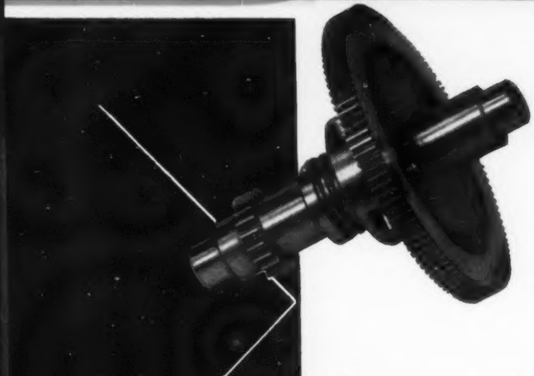
GUARANTEED ACCURACY

with standard-type precision

hobbing machines



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



The Kearney and Trecker Corporation have designed a servo-control mechanism for controlling an airframe section profile and contour milling machine. The extreme accuracy required for the transfer of motion in this mechanism demanded a whole new approach to the production of gears at Kearney and Trecker.

Barber-Colman Engineers were consulted for their suggestions to assure gear accuracy for this program. They recommended a standard-type No. 6-10 Precision Hobbing Machine and designed special tooling for each of the eight gears in the mechanism. They also specified the preparation of the blanks for hobbing.

This machine is guaranteed to cut a 4″ diameter spur gear within .0002″ adjacent and .0004″ non-adjacent spacing error checked on an optical dividing head. The blanks are ground on the diameter and sides, holding the diameter, parallelism and radial and axial runout within .0001″. Two holes are provided for driving the gear during hobbing.

These photographs show one of the gears in the train and the special tooling designed for it. The blanks are located between centers and are driven by a diamond-shaped pin in the backing plate. For hobbing this 48 D.P., 115 tooth gear, a feed of .010″ is used, and the hob speed is 183 R.P.M. The material is stress-proof steel R.C. 27. Barber-Colman Class AA taper-bore hobs are used and resharpened to original hob accuracy on a Barber-Colman No. 6-5 Hob Sharpening Machine.

With this equipment and recommended procedure, all gears in the train are hobbed well within Precision Class 2 AGMA tolerances. The success of this program is indicated by the results obtained on the example shown. Inspection shows these gears are consistently within .0002″ tooth-to-tooth and .0004″ total composite error.

Accuracy of this degree is not unusual with Barber-Colman machines and hobs. This case shows the results which can be obtained by working closely with, and following the recommendations of, experienced hobbing technicians. When you have applications requiring accurate gears, consult Barber-Colman hobbing experts for their recommendations.

BARBER-COLMAN COMPANY

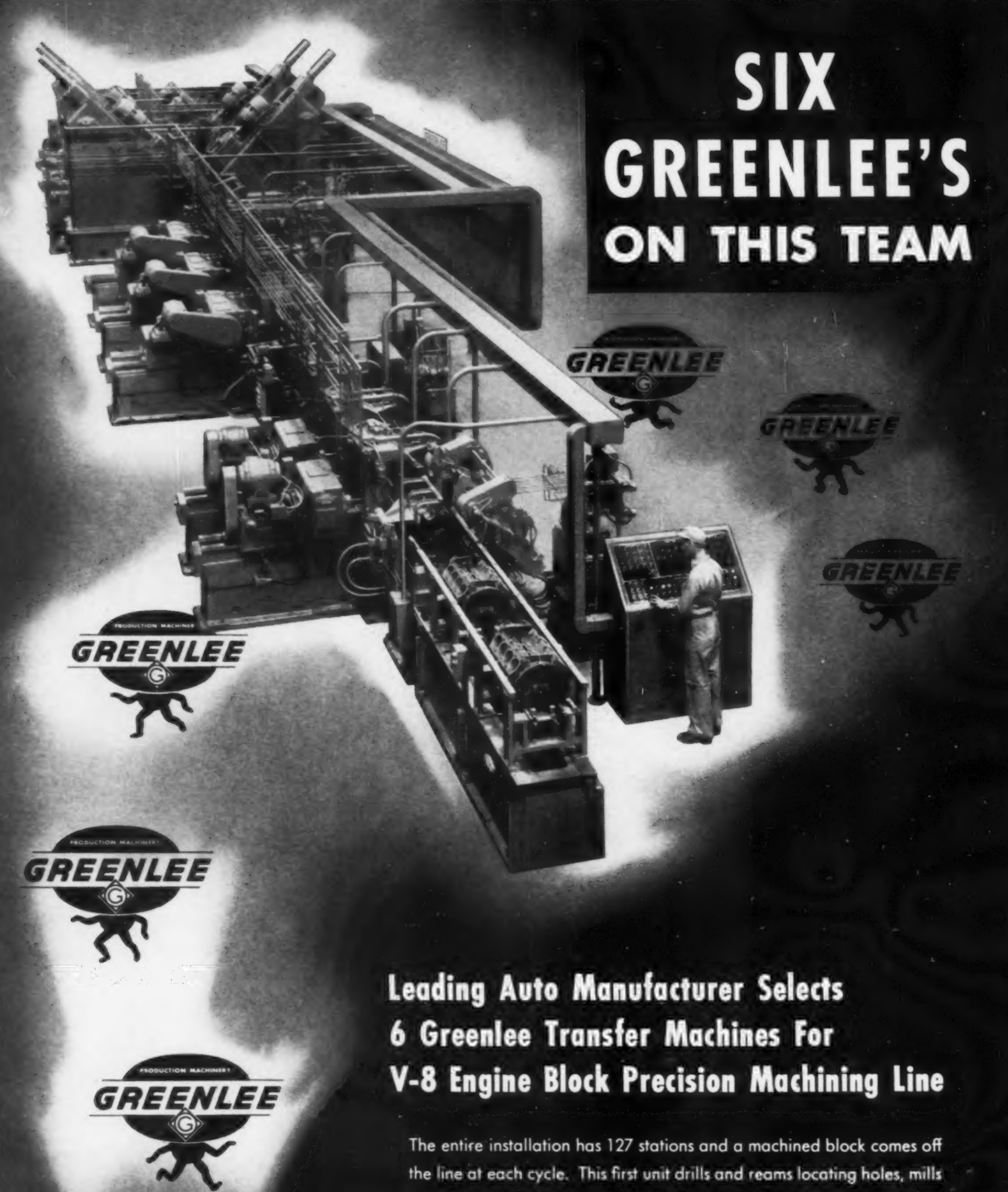
6212 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

SIX GREENLEE'S ON THIS TEAM



Leading Auto Manufacturer Selects 6 Greenlee Transfer Machines For V-8 Engine Block Precision Machining Line

The entire installation has 127 stations and a machined block comes off the line at each cycle. This first unit drills and reams locating holes, mills main bearings to width; mills lock slots, oil seal and slinger grooves, fuel pump and filter pads and rough bores cylinders. It also has a gauging station to check locating holes, a reject station and three turnover stations, the last of which positions the block for the next machine.

WRITE FOR COMPLETE INFORMATION

GREENLEE BROS. & CO. | 1762 MASON AVENUE ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

For more information fill in page number on Inquiry Card, on page 233

announcing

Programming by numerical control for Fosmatic Jig Borers

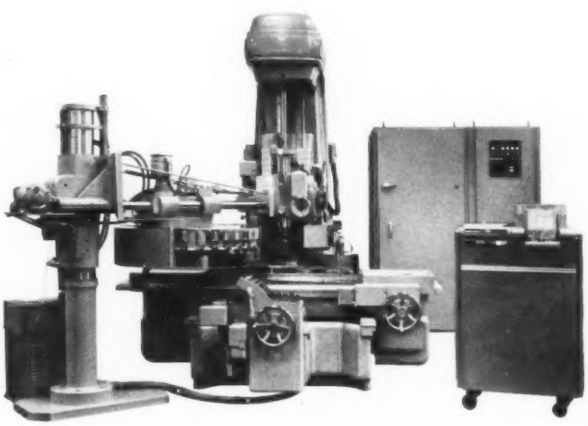
One important objective of automation is to remove unnecessary steps and human decisions which occur between production engineering and finished product. Stated another way—to keep control of important manufacturing operations in the hands of qualified technical experts. To this end, The Fosdick Machine Tool Company and the International Business Machines Corp. have adapted numerical control to all functions of Fosmatic Jig Borers. As a result, any jig boring operation can now be completely programmed and controlled by punched cards or tapes. Once the work piece is loaded on the jig borer, the following functions can be controlled completely automatically: Table and Saddle Locations   Spindle Feeds and Speeds   Feed Depth   Spindle Head Height   Automatic Tool Changing.

Dimensions, feeds, speeds, etc. are charted by the Production Engineering Department, then tape or cards are punched (a simple clerical procedure).

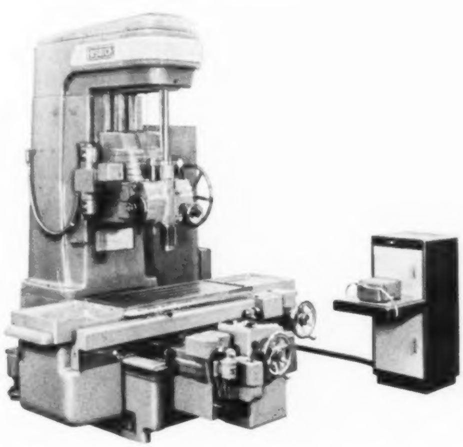
Optimum programming can be achieved by using an automatic computer which will establish the best possible sequence of operations.

Many plants, of course, are not yet ready for the total automation just described. They do, however, face problems of precision, production rate, efficiency and quality control which can be partially or wholly solved by automating one or more of the above functions. In effect, we offer exactly the degree of boring automation your plant is ready for.

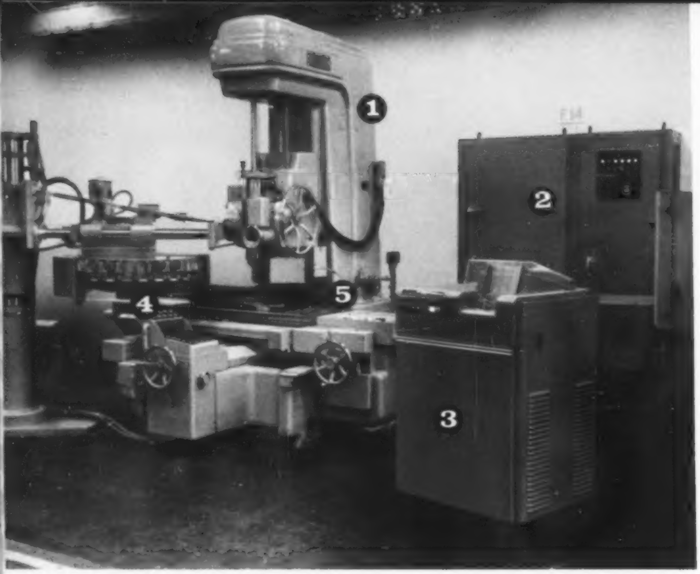
A meeting with your Fosdick representative will help you quickly determine just how these dramatic new methods can best serve your production needs.



IBM card-controlled Fosmatic Jig Borer programs table and saddle location, spindle feeds and speeds, feed depth, head height and tools.



Tape-controlled Fosmatic Jig Borer built for the General Electric Company, Aircraft Gas Turbine Division, Production Engine Department.



1. *Fosmatic Jig Borer*
2. *Control Panel*
3. *IBM Card Reader*
4. *Automatic Tool Changer*
5. *Automatic Hole Depth Control*

Numerical control on the Fosmatic Jig Borer, gives

Exactly the degree of boring automation your plant is ready for.

By controlling numerically one or more—or all—of these functions on your Fosmatic Jig Borer, you can accomplish exactly the kind of boring programming that fits best into your present operation.

By controlling table and saddle location, you will establish definite work sequence. This, of course, can be worked out by your production experts to give optimum efficiency—eliminates leaving these important decisions up to the operator. By adding the other numerically controlled functions you can assure that those functions are performed without possibility of error or lost time. These advantages apply to single piece jobs as well as to precision production runs. In both cases, the result is lower cost per piece.

A considerable savings in set-up time can be realized with this equipment when compared with other methods of doing small and medium production runs. Only a single setting on the workpiece in each direction of table travel is required. Since set-up time is very short, real savings in inventory can be made. And greater flexibility in scheduling can be achieved through use of shorter production runs.

In many situations, jigs and fixtures are eliminated, with their high cost and long lead time.

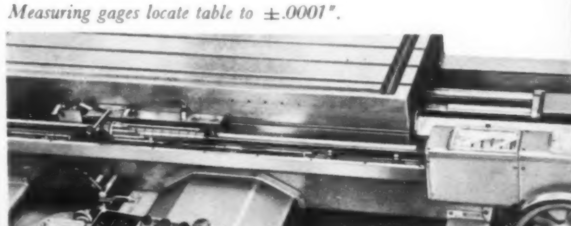
Shown and described here are the five basic jig borer functions which can be numerically controlled. They are available individually or as a group and are recommended in the order discussed.

Numerical Control of Table and Saddle Location.

This basic control automatically locates the workpiece under the spindle within ±.0001 of the specified dimension. For measurements along the X and Y coordinates, a series of Class A measuring gages are lined up. There are gages in even tens of inches, gages in increments of one inch, gages in increments of tenths of inches and so on down to increments of .0001 inch. These gages are selected through motor-driven drum dials so that they are placed end to end to provide the required dimension.

Movement of the table stacks the gages and moves them to operate a switching mechanism. At the point of final position the table movement is stopped, the trav-

Measuring gages locate table to ±.0001".



erse screw is relieved by reversing it slightly and the table is clamped.

The numerical control of coordinate locations consistently reduces the time required per piece. The table automatically proceeds from one location to the next as each operation is completed without any lost time. Even on a machine equipped with numerical control of only table and saddle, the table will reach position before the operator has changed tools. This feature will also bring about improved quality of the parts being machined by eliminating operator errors. Table locations will always be accurate to ±.0001".

Numerical Control of Spindle Feeds and Speeds.

Additional time can be saved through automatic control of spindle feeds and speeds. This is accomplished on the Fosmatic Jig Borer through magnetic clutches in the gear trains. Speed and feeds are changed instantly from information stored on the punched cards or tape. When this feature is added to numerical control of the table and saddle, the feeds and speeds are changed as required with absolutely no loss of time. Correct feeds and speeds assure required finish and accuracy of hole diameters.

Numerical Control of Spindle Feed Depth.

This is another time saving feature that can be applied to the Fosmatic Jig Borer. The correct depth is held within .002 inch every time, eliminating operator errors.

In operation, the spindle is advanced in rapid traverse and shifts into the desired feed rate when the cutting tool is approximately 1/16" from the surface of the work piece. The spindle then feeds down to the prescribed depth where feed and rotation are stopped and the spindle is retracted.

Spindle rapid traverse is controlled by a photoelectric unit. As the tool moves down, it passes through a beam of light; this energizes an electronic counter which allows the spindle to continue to traverse a pre-determined distance. At this point it shifts into cutting feed rate.

When the tool contacts the work, the electronic counter is re-energized by means of a vibration pickup on the fixture to control the depth of feed.

Numerical Control of Spindle Head Height.

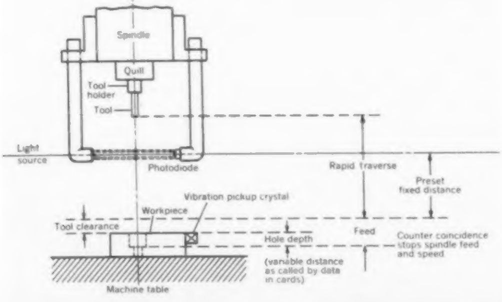
This feature insures that the head is always at the correct height so that even work pieces with hole surfaces with extreme differences in height can be run automatically. The operator's judgment is not required to determine what head positions are required to reach all holes in the part with the spindle travel available. The head will always be at the correct height.

Numerical Control
of the Automatic Tool Changer.

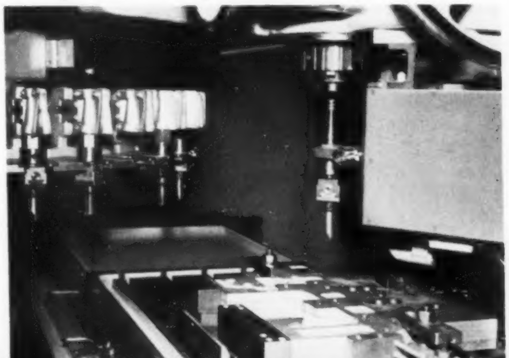
Addition of the numerically controlled tool changer to the features previously discussed makes these machines completely automatic. With a capacity of 30 or more tools in the tool rack, the Fosmatic Jig Borer is capable of completing all drilling, reaming, boring, counter-boring and tapping operations in a very wide range of jobs, all automatically.

Each of the tools used in the tool changer

Schematic shows operation of automatic depth control.



Boring tool has been removed from the storage rack by automatic wrench. Spindle will feed down at slow rpm and engage thread until a pre-determined torque is reached.



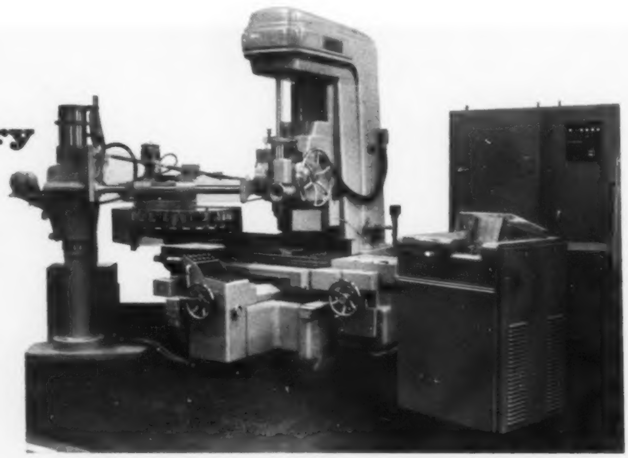
has a tapered shank with a straight external thread at the top of the taper.

Each boring tool is set for diameter in the tool room. Each tool is numbered and is inserted into the tool rack at the corresponding number.

The sequence of events in changing tools is as follows:

1. The spindle is retracted to the top of its travel.
2. The tool rack indexes to the specified location by the shortest route.
3. The tool rack moves radially under the spindle.
4. An automatic wrench mounted under the spindle advances and locks on a hex section of the tool just below the taper shank.
5. The tool rack is retracted leaving the tool locked in the wrench with the shank upward.
6. The spindle feeds down at slow speed and engages the thread at the end of the tool shank.
7. When a pre-determined locking torque is reached, the wrench opens and retracts, clearing the space under the spindle.
8. The spindle feeds down and completes the programmed operation.
9. To remove the tool from the spindle, the spindle is retracted to the level of the wrench and the above steps, in reverse sequence, take place.

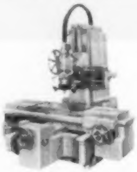
IBM saves on machining and inventory



At Endicott, New York, International Business Machines Corporation uses its numerically controlled Fosmatic Jig Borer in the production of side frames for its data processing equipment.

Thirty operations are performed on each part. Total hole location error in the 16" by 18" side frames has never exceeded .0004".

In addition to the savings in the direct cost of machining, IBM says that the shorter set-up times with the card-controlled Fosmatic permit inventory savings due to reductions in optimum manufacturing orders.



Numerical control by punched cards or tape is also available for the *Moore-Fosdick jig grinders*.

May We Discuss Numerical Control With You?

If you are producing parts with precision holes in any quantity, we'd like to talk to you about numerical control. We will analyze your requirements to see what savings can be made. Just write us with a description of your job.

FOSDICK

Need boring equipment? Get a proposal from Fosdick!

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

LITHO U. S. A.

11-57 86.5M-H

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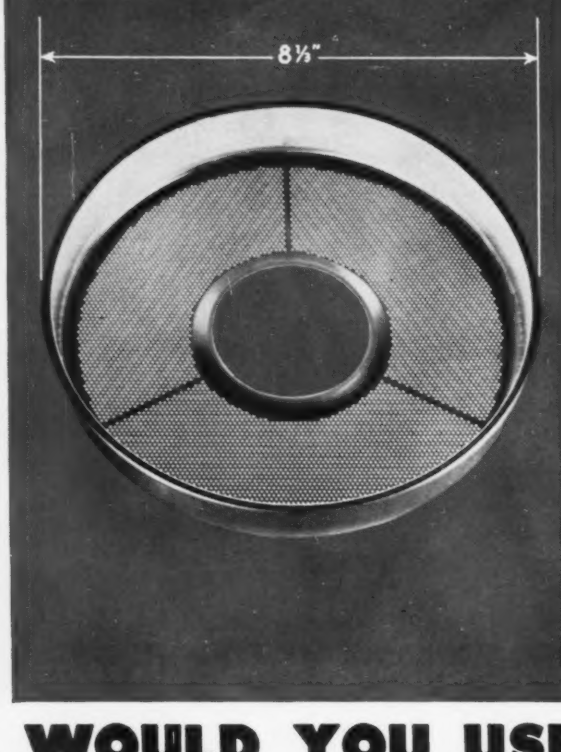

WHICH DIE STEEL WOULD YOU USE

to be sure of getting 6,066 perfect holes in this die?

These tools are used in a 60-ton press to pierce 6,066 holes of .036" dia. in aluminum filter pans for a popular home appliance. The job demands "almost everything" from the die steel . . . good machinability and uniformity, minimum size change, extra safety in hardening and toughness to withstand heavy press loads.

The filter pans are 8⅓" in dia., and .025" thick. The 6,066 holes are perforated in three blows, as the die moves through three 120 degree indexing stations. Hundreds of machine hours are involved in drilling and taper reaming the tiny holes.

If the decision were up to you . . . on which die steel would you be willing to stake your reputation in view of this tough set of requirements?

In this Field Report from customer files, here are the amazing results: Working with Carpenter VEGA (Air-Tough) Die Steel, the company reports that not a single "hard spot" was encountered . . . *all 6,066 holes are in the die as planned.* The machining of VEGA was "considerably easier" than the machinery steel used for the stripper plate. What's more, there was no discernible change in size or shape after heat treatment . . . *the die held perfectly!*

You can count on good results from any Carpenter Matched Tool and Die Steel. Take the risk out of your tough tooling jobs. Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for immediate delivery.

Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 105 W. Bern St., Reading, Pa.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

® U. S. Patent Office, The Carpenter Steel Co., Reading, Pa.

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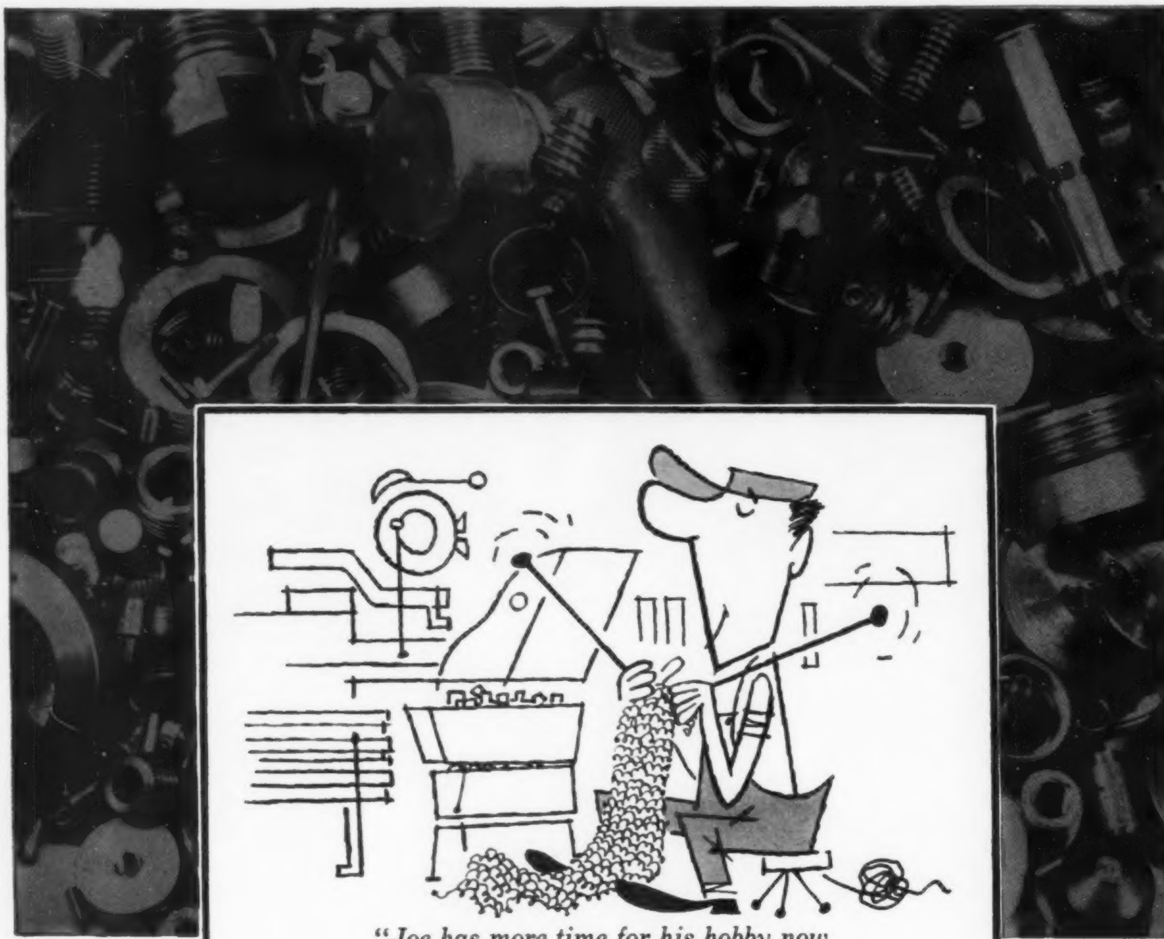


"Joe has more time for his hobby now —we've switched to MX"

It's surprising what a difference USS Free-Machining MX Steel can make. Parts come off the machine faster—tools last longer—there's less down time—rejects are practically eliminated.

No wonder that hundreds of shops, where this high-speed, fast-cutting bar stock has been put to work, report substantial *cost savings.* These savings average between 10 and 15%; in some cases have run as high as 42%. With MX they're not only getting more parts per hour but better parts—more accurate and of finer finish—at lower cost per part.

Why not switch to USS Free-Machining MX? *It costs no more than regular screw stock,* yet it has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today.

Production-boosting, cost-reducing MX steel is produced in all the popular screw stock sizes. It is available in both Bessemer and Open Hearth grades. You can obtain it in cold-finished form from your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest sales office.

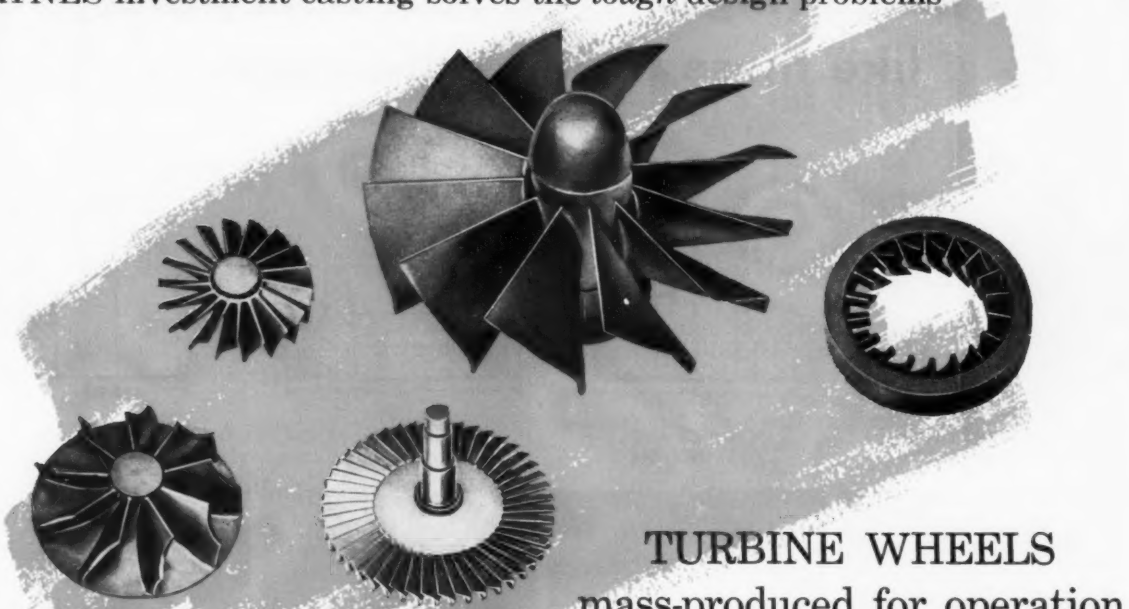
UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output . . . longer tool life . . . lower costs

USS —*when you do the job with free-machining* MX

UNITED STATES STEEL

HAYNES investment casting solves the *tough* design problems



TURBINE WHEELS
mass-produced for operation up to 1700 Deg. F

Special inspection equipment guarantees accuracy. Examinations by Gamma Ray (above) is one of a number of inspection methods used at Haynes Stellite Company's plant to insure top quality control.

Turbine wheels with intricate blading—some as thin as 0.020 in.—and ranging in diameter from 2 to 21 in. are now mass-produced economically by HAYNES' investment-casting method. The blades and wheel are produced as one integral part to close as-cast tolerances.

HAYNES' investment-casting method offers the design engineer a selection of alloys developed for economical operation over a wide temperature range—from room temperature to 1700 deg. F. The cast wheels have high strength and are capable of operating at speeds in excess of 42,000 revolutions per minute.

The freedom to select alloys for performance and to design for top efficiency is one of the big advantages of HAYNES' investment-casting process. For full details, write for the booklet "HAYNES' Investment-Casting." Address Haynes Stellite Company, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.

HAYNES
ALLOYS
HAYNES STELLITE COMPANY
Division of Union Carbide Corporation

UNION CARBIDE

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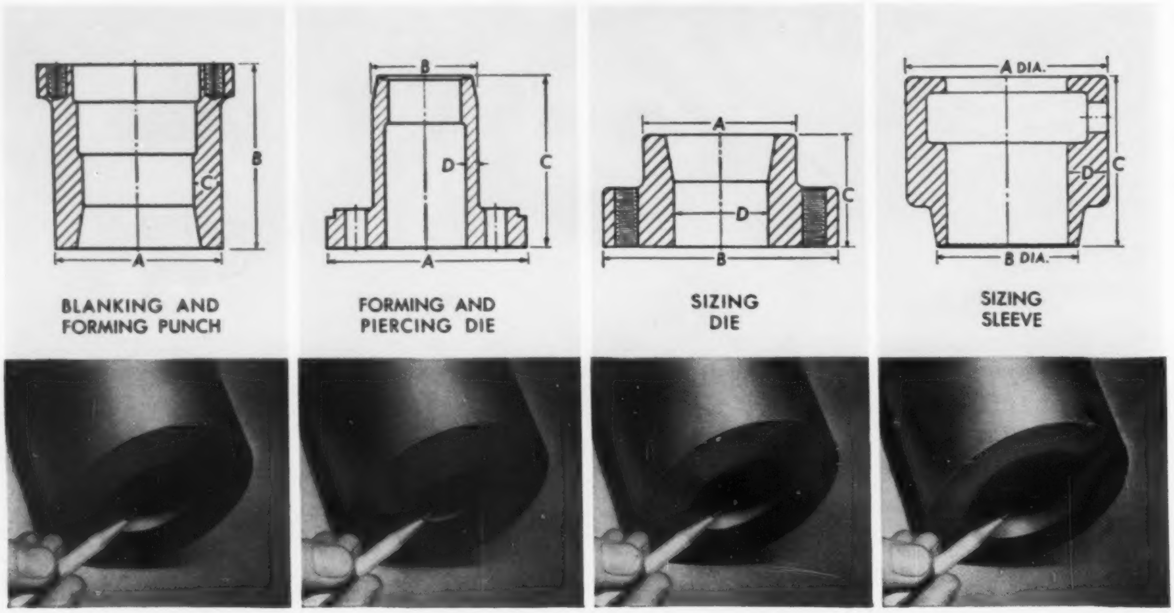
Make ring-shaped tool steel parts like these faster, at less cost...



Make 'em from Graph-Mo Hollow Bar®
—the hole's already there

IF you're looking for a faster, more economical way to make your ring-shaped tool steel parts—and get a better finished product—here's the answer. Use Graph-Mo Hollow Bar®. Because drilling is eliminated, you cut costs and speed production. And you get a tool steel that machines faster, wears longer, gives more stability.

Graph-Mo machines faster than ordinary tool steels because of the free graphite in its structure. And there's far less tendency to pick up, scuff or gall.

Users report that Graph-Mo outwears other tool steels by 3 to 1 *on the average!* This durability results from the combination of free graphite and diamond-hard carbides in Graph-Mo's structure.

And there isn't a more stable tool steel than Graph-Mo Hollow Bar. For example: after 12 years of use, a master plug gauge machined from Graph-Mo showed less than 10 millionths of an inch dimensional change.

To make ring-shaped tool steel parts faster at less cost, specify Graph-Mo Hollow Bar. You'll have a better finished product. And you can choose Graph-Mo Hollow Bar from 3 to 16 inches in O.D. with many wall thicknesses. For more information write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

STRIP
RINSE
PICKLE
RINSE
NEUTRALIZE
RINSE

Here's the best shortcut in the field of organic finishing

One operation usually removes paint, rust and oil at the same time.

One tank of Oakite Rustripper frequently does all these jobs: (1) strip rejects and conveyor hooks; (2) pickle rusted stock; (3) prepare reconditioned products for refinishing operations.

One tank may eliminate many tanks used in ordinary cycles.

OAKITE
RUSTRIPPER

RINSE

PREPAINT → DRY → PAINT

FREE Our illustrated booklet tells how this amazing cleaner - stripper - deruster offers tremendous possibilities for saving minutes, hours, dimes, dollars. Write or send coupon for your copy.

ALKALINE CLEAN
RINSE
PICKLE
RINSE
ELECTROCLEAN
RINSE

Here's the best shortcut in the field of electroplating

One operation usually removes rust and oil at the same time. One alkaline tank may remove oxides, drawing compound residues and other stubborn soils . . . even strip zinc from rejects and racks.

Sensational Oakite Rustripper frequently eliminates acid pickling and its troublesome after-effects: (1) hydrogen embrittlement; and (2) smut that must be removed by electro-cleaning or hand brushing.

OAKITE
RUSTRIPPER

RINSE

ELECTROPLATE ← RINSE ← CYANIDE or ACID DIP

FREE Our illustrated booklet tells how this shortcut may save you time and money—in tank lines, in automatic platers, in barrel lines—by saving equipment, floor space, acids, water, steam and electricity. Write or send coupon for your copy.

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☐ *"Here's the best shortcut in the field of electroplating"*

NAME ______________________

COMPANY ______________________

ADDRESS ______________________

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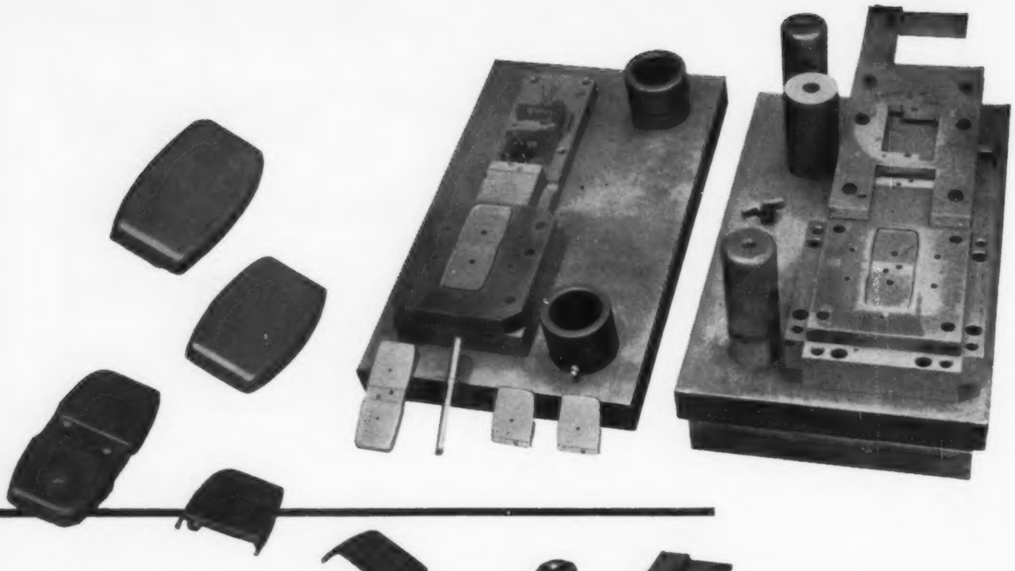
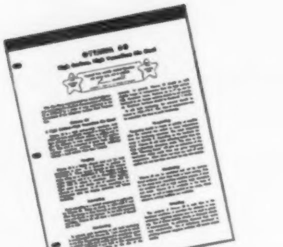


These OTTAWA 60 DIES PAYOFF BIG IN 3 WAYS

- ★ **Buffing Time Reduced ½**
- ★ **Rejects Reduced 20%**
- ★ **Stoning and Regrinding of Dies Reduced 75%**



Write for BLUE SHEET on OTTAWA 60

This concise four-page folder gives all needed handling and shop treatment details on Ottawa 60. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. M-96.

One way to increase profits is to reduce finishing costs. That's what a fabricator of hearing aid cases accomplished when he switched from regular die steel to A-L's air hardening Ottawa 60 high carbon-high vanadium grade.

Ottawa 60 dies produced stainless steel cases which were free from galling and scoring—were nearly perfect as they came out of the dies. Less than half the previous buffing time was needed to bring them to the required high finish. Rejects—which ran about 20 percent before the use of Ottawa 60—were reduced almost to the point of elimination. Also, the new Ottawa 60 dies required stoning and regrinding only a quarter as often as the standard tool steel dies they replaced.

This same manufacturer has passed along significant savings to other customers through the use of Ottawa 60. By practically eliminating rejects due to corner cracking and scoring, customers receive better stamped parts at lower per-piece cost.

Let us show how you, too, can save with A-L tool steels and, at the same time, furnish your customers a better product.

Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

For nearest representative, consult Yellow Section of your telephone book.

For complete MODERN Tooling, call

Allegheny Ludlum

A-L FINE TOOL STEELS SINCE 1854 ®

WSW 6648

HARDNESS HOOK ANGLE MAJOR DIAMETER LEAD

Rake

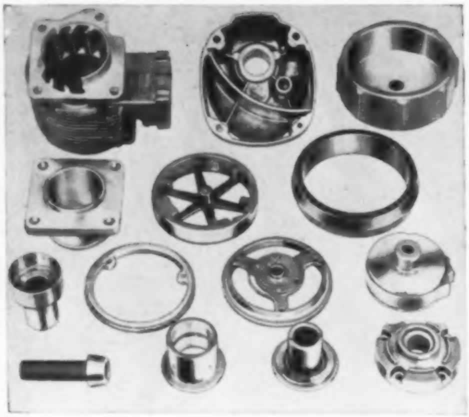
MINOR DIAMETER RELIEF HELIX CONCENTRICITY PITCH DIAMETER

Rake, or hook (curved rake), is an all important element in the cutting ability of a tap tooth. The angle required to cut tool steel will not do the same job on cast iron, or brass, or aluminum. For every material there is a best rake or hook angle.

Whether they are stock taps with standard rake or hook for general purpose tapping; special purpose stock taps for a specific material; or special taps, cutting angle could mean success or failure on the job.

"Greenfield's" quality control includes checking this vital element on equipment especially designed for the purpose.

GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

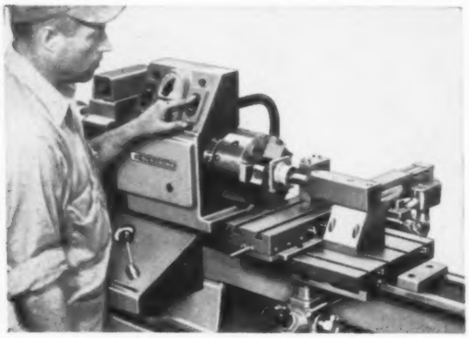


If your operations call for turning, boring, facing, forming, grooving, chamfering, beveling, or cut-off of parts such as these (pieces shown merely suggest the almost endless variety), there's a CLAUSING Hydra-Cycle for handling these operations in combination or singly, with great speed, to close tolerances, and at low cost.

500%

PRODUCTION INCREASE—PROPORTIONATE COST REDUCTION IN SMALL PARTS MACHINING!

MODEL 6405
4 Operating
CYCLES



All the operator has to do is load the machine, press a button, take out the machined piece seconds later. The Hydra-Cycle does the rest, automatically.

THE NEW CLAUSING SEMI-AUTOMATIC BORING AND TURNING MACHINE

4 MODELS—ONE TO MEET YOUR EXACT NEEDS

Users report production increases of 200% to 500%, with corresponding cost reduction, and jobs have been held to .0002 tolerance on production runs. Average job change and set-up takes from 15 to 30 minutes. No special jigs or fixtures required . . . simple block tool holders, carbide insert bits and standard boring bars will handle most jobs. Operator merely loads, presses starter button, and unloads finished pieces *seconds later* . . . machining operations are performed automatically . . . simultaneously or in continuous sequence. A time and money saver on short as well as long production runs.

SPECIFICATIONS: 5″ x 16″ cross slide with 4-11/16″ swing, 5″ travel; 12″ x 14″ table with 9″ swing, 8″ travel. Prices start at $4250 with electricals and hydraulic equipment installed.

Six surfaces are being machined in the operation shown above. As is the case with most jobs that can be handled by the Hydra-Cycle, the tooling required is simple, inexpensive.

NO OBLIGATION OFFER!

Simply send us complete data . . . drawings of rough and finished part, indicating material, tolerances, finish required, production rate — and, samples of finished and unfinished parts. Our engineering department will gladly make recommendations for the use of the Hydra-Cycle model best suited to your requirements. No obligation. Mail to Hydra-Cycle Department, Clausing Division, Atlas Press Company, Kalamazoo, Michigan.

CLAUSING

CLAUSING DIVISION
ATLAS PRESS COMPANY
12-108 N. Pitcher St. — Kalamazoo, Michigan

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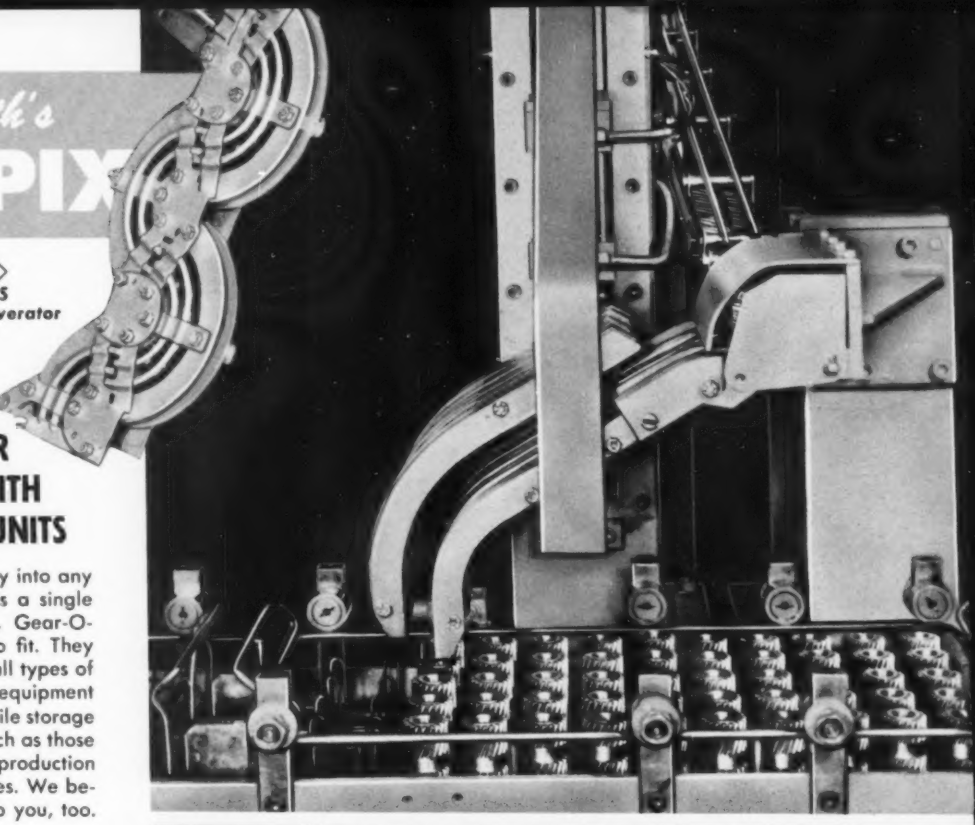
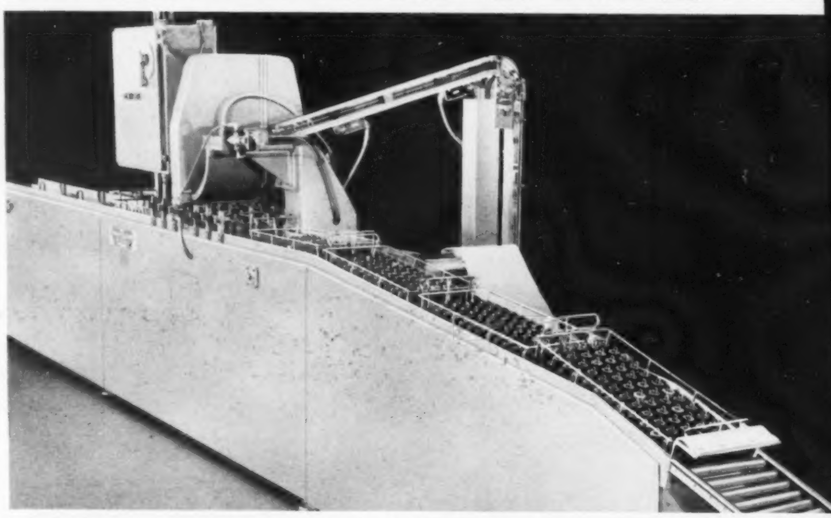
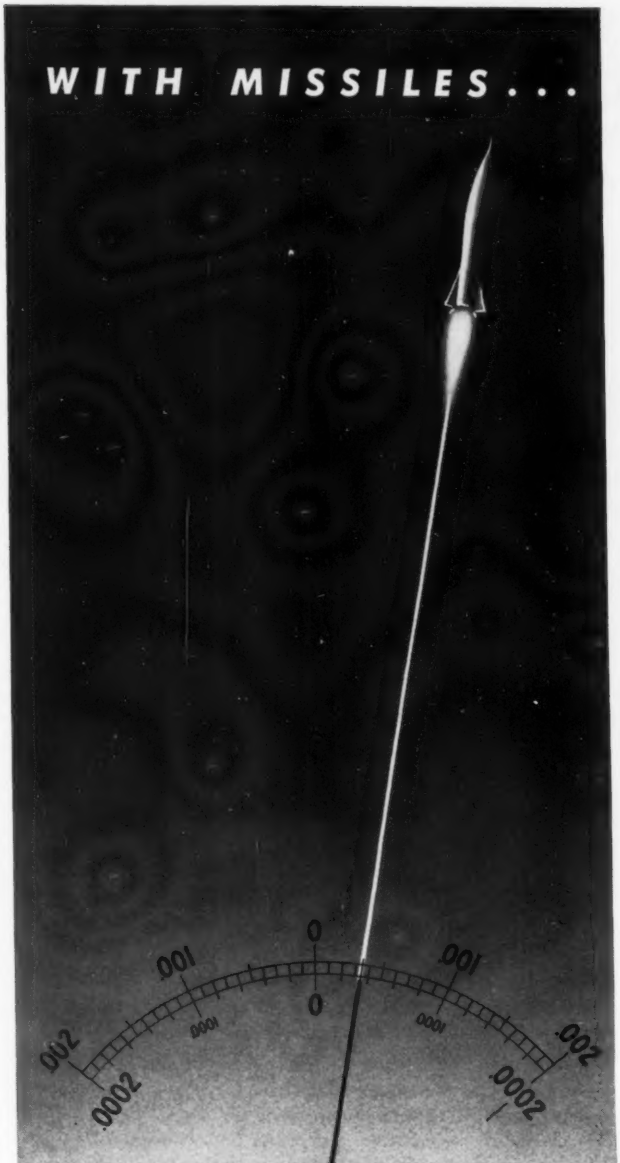




GEAR-O-MATION
GEAR-O-MATION



SO MUCH DEPENDS ON PRECISION GAGING

it pays to rely on —

FEDERAL

Precise control over dimensional accuracy of missile parts and components is an acknowledged necessity. Whether the machined part must be accurate to .001" or .000010", its conformity to size must be known with unquestionable certainty.

Supplying gages that provide high-order precision and dependability calls for special engineering experience and skill, plus a full understanding of the unusual problems involved. Over thirty-five years' experience and 30,000 successful gage designs, many of them for missile contractors and sub-contractors, proves that Federal has these qualifications. Whether you need one gage or a whole gaging program, Federal's experience in gages and gaging programs for missiles can pay off in safeguarding your productive effectiveness.

Only Federal has four different systems of gaging from which to impartially select the one best suited to your needs — another reason why Federal has more to offer in precision measurement.

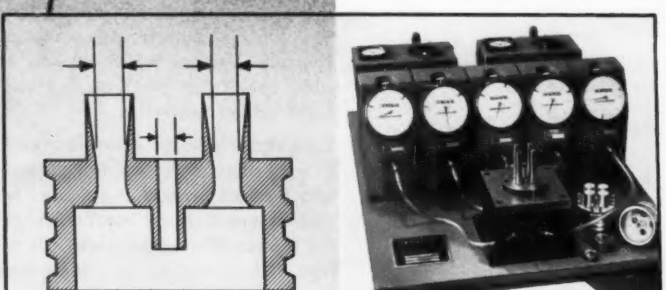
We're ready to offer you precision gaging ideas which have been so successful for other producers of missile parts and components.

Write us concerning your needs.

FEDERAL PRODUCTS CORPORATION
71112 Eddy Street **Providence 1, R. I.**

FEDERAL has supplied precision gaging for: —

- **NIKE**
- **ATLAS**
- **SPARROW**
- **FALCON**
- **FIREBEE**
- **CORPORAL**
- **DART**
- **MATADOR**
- **NAVAHO**



FOUR NOZZLE DIAMETERS CHECKED SIMULTANEOUSLY
Multi-unit air gage (Dimension-air) uses four contact-type air plugs to check diameter of land in nozzles (tolerance $\pm$.0005"). Regular air plug checks centrally located bore (tolerance $\pm$.0002"). Nozzle assemblies and masters shown on gage platform.
(Other missile gaging applications to .000010" accuracies.)

Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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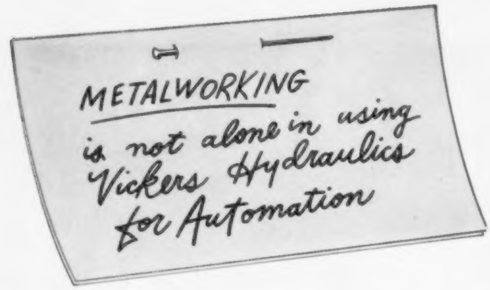
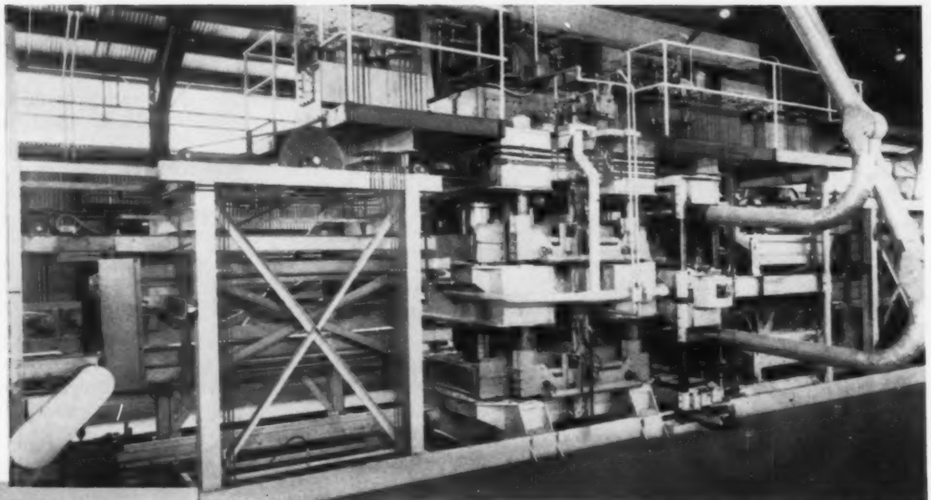
AUTOMATION

IN HARDBOARD PRODUCTION

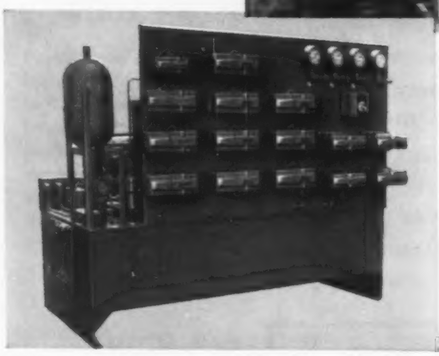
With VICKERS® HYDRAULICS



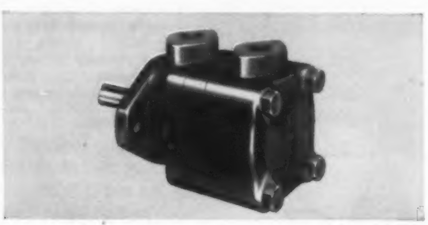
REDUCES COSTS • IMPROVES UNIFORMITY • PROVIDES FLEXIBILITY



Prepress area of automatic hardboard plant designed and built as a package unit by the Industrial Development Company, Tacoma, Washington for Columbia Hardboard Company, Inc.



This Vickers Custom-Built Power Unit is individually designed to meet specific needs. It assures dependable performance, improves and simplifies design, reduces installation time and cost, and makes servicing easier. Write for Bulletin 52-45.



The performance-proven Vickers Balanced Vane Type Hydraulic Motor is an economical, efficient, and compact means of providing variable speed rotary power. It can be used for reversing service and can be stalled under load without damage. Write for Bulletin I&M-5103.

7834

Reported to be the most highly automated in the wood products industry, this plant produces 60,000 sq ft of "Cedawood" per day (½" basis).

Seven Vickers Custom-Built Hydraulic Power Units play an important part in this performance; four are shown (in the photograph above) mounted on the platform directly above the prepress. The other three operate a series of automatic transfer systems in various parts of the plant. The transfer drives also use Vickers Vane Type Hydraulic Motors, which provide easily controlled variable speed for synchronizing various operations and for overload protection.

The use of hydraulic variable speed drives makes it easy to vary production rate, flakeboard thickness (⅛" to 1"), and type of product. Additional features are: accurate control, simplicity of installation, and low maintenance. For further information about the many benefits you get from Vickers Hydraulics, ask for Bulletin 55-67.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

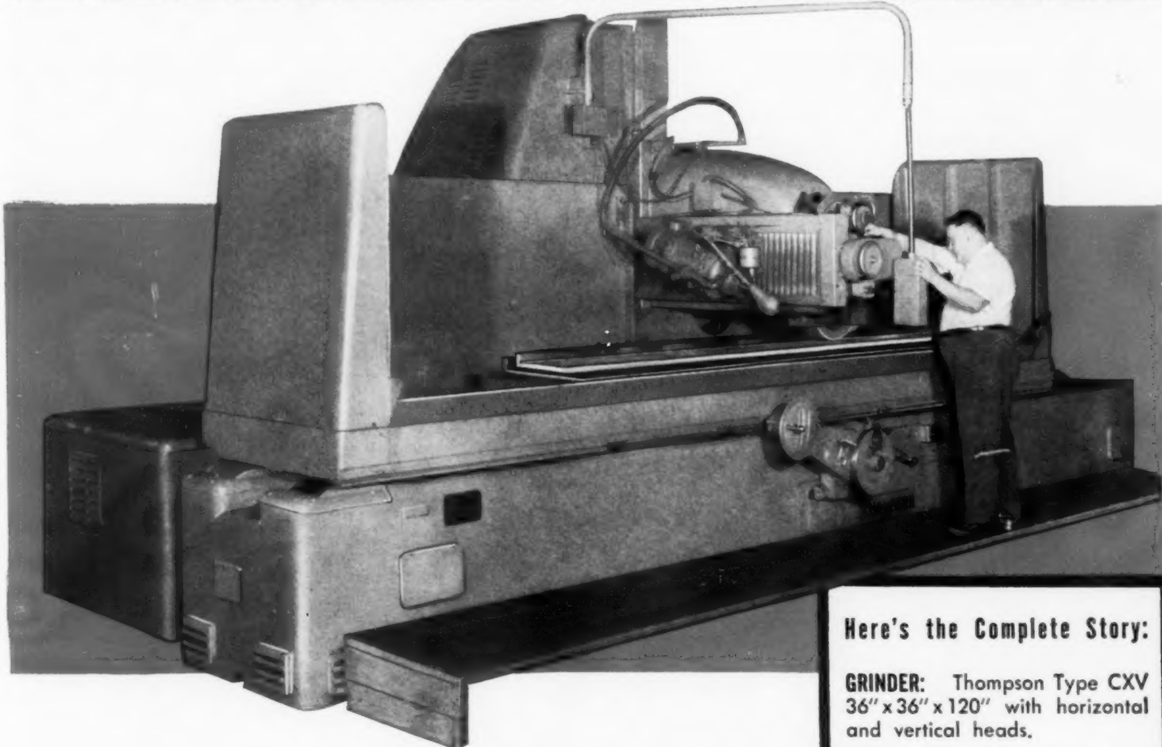
Machinery Hydraulics Division

ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

Application Engineering Offices: **ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WORCESTER**
FACTORIES ALSO IN AUSTRALIA, ENGLAND AND GERMANY
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto and Montreal

When large parts must be ground to total tolerances of .0005" or less ....

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM SOLVE THE PROBLEM!



Machine ways up to 118" for The Michigan Tool Company's Roto-Flo Spline Rollers must be ground to .0005" total tolerance. Heat distortion, caused by hydraulic heat, became a critical problem in achieving this tolerance.

During the three months of operation since the installation of Thompson's new Hydra-Cool Hydraulic System*, these long ways are being ground to consistent .0003"-.0004" total tolerances. Heat distortion is eliminated. Scrap loss is reduced to zero. Grinding time is greatly reduced.

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM MAY BE THE ECONOMICAL SOLUTION TO YOUR GRINDING PROBLEM. WRITE TODAY FOR FULL PARTICULARS.

Hydra-Cool also offers you these exclusive advantages:

- Heat damage to hydraulic seals, valves, controls and pump is eliminated.
- Break down of additive-type hydraulic oils is prevented—sludge will not form in the Hydra-Cool System.
- Lengthy warm-up periods are eliminated.
- Power costs are greatly reduced.

Hydra-Cool is standard on all Thompson surface grinders 40 inches and up in work length AT NO EXTRA COST.

Here's the Complete Story:

GRINDER: Thompson Type CXV 36" x 36" x 120" with horizontal and vertical heads.

PART: 118" way for Michigan Tool Co. Roto-Flo Spline Roller.

RATE OF TABLE TRAVEL: 100 ft./Min.

MATERIAL REMOVED: .065".

METAL: Flame hardened Ductile Iron.

WHEEL: 20x4x12 H Grade.

SCRAP LOSS: None.

GRINDING TIME: 3-4 hrs.

Thompson
SURFACE GRINDERS

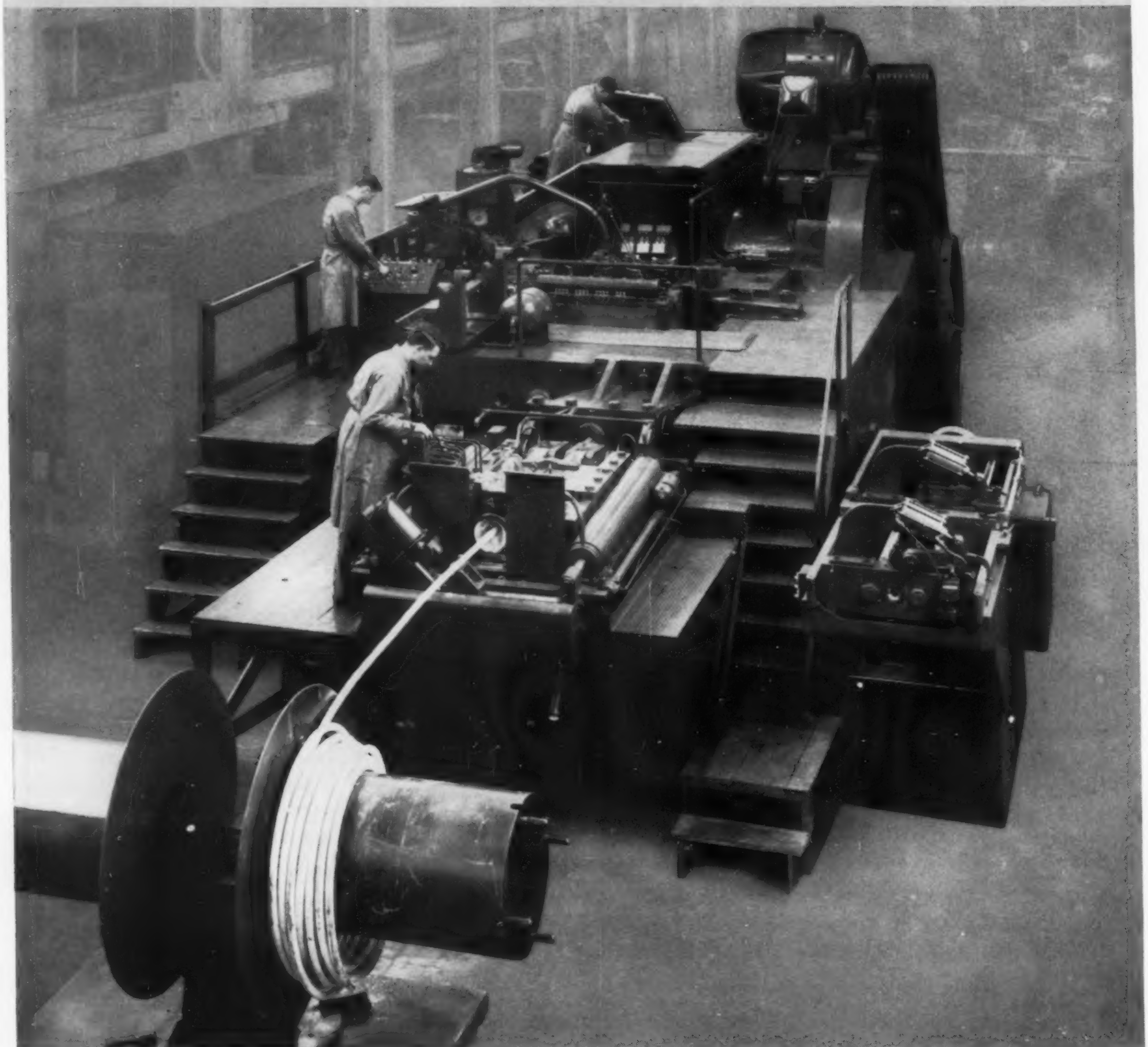
THE THOMPSON GRINDER CO., Springfield, Ohio, U. S. A.

"Keep **THOMPSON** *in mind for that daily grind"*

*Pat. Applied For

For more information fill in page number on Inquiry Card, on page 233

Cleveland Cap Feeds This Biggest 13 Minutes and Produces *494*



THE 1-1/4-INCH BOLTMAKER

WEIGHT: 400,000 POUNDS
MOTOR HORSEPOWER: 200
PIECES PER MINUTE: 38

Boltmaker One Ton of Steel Every Four-Pound Cap Screws . . .

20 Times Faster!

This 1-1/4" x 10" Cleveland precision cap screw is now being cold-forged automatically on the Boltmaker at the rate of 38 per minute.

This tremendous 1-1/4" Boltmaker opens new horizons in the automatic cold-forging of metal components. It is the largest machine of its kind ever built, four times larger than its immediate predecessor, the 3/4" Boltmaker.

We pioneered this first 1-1/4" Boltmaker for The Cleveland Cap Screw Company. Specialists since 1916 in cap screws, set screws, studs and fasteners, including "larger than usually listed sizes," Cleveland Cap is now relying on its new 1-1/4" Boltmaker for the exacting task of producing the large cap screws illustrated above.

In this forging operation, the Boltmaker draws the steel rod to size, cuts it to proper length, extrudes the blank, heads, trims the head, points the end and rolls the threads, *all automatically!* All operations occur at one time and a complete, ready-to-use cap screw is cold-forged on each stroke of the machine. Grain flow in the head and threads is symmetrical and unbroken. The part is stronger because the forging action increases fatigue resistance and tensile strength.

This giant Boltmaker can be tooled to cold-forge many other large-size special products.

Whether your forging problem is one of making four-pound precision cap screws or a wide variety of other metal components in various sizes, we invite you to send us your prints and samples. Better yet, pay us a visit, and discuss with us how the latest methods, machines and ideas fit into your future metalworking production.

NATIONAL MACHINERY COMPANY

TIFFIN, OHIO—SINCE 1874

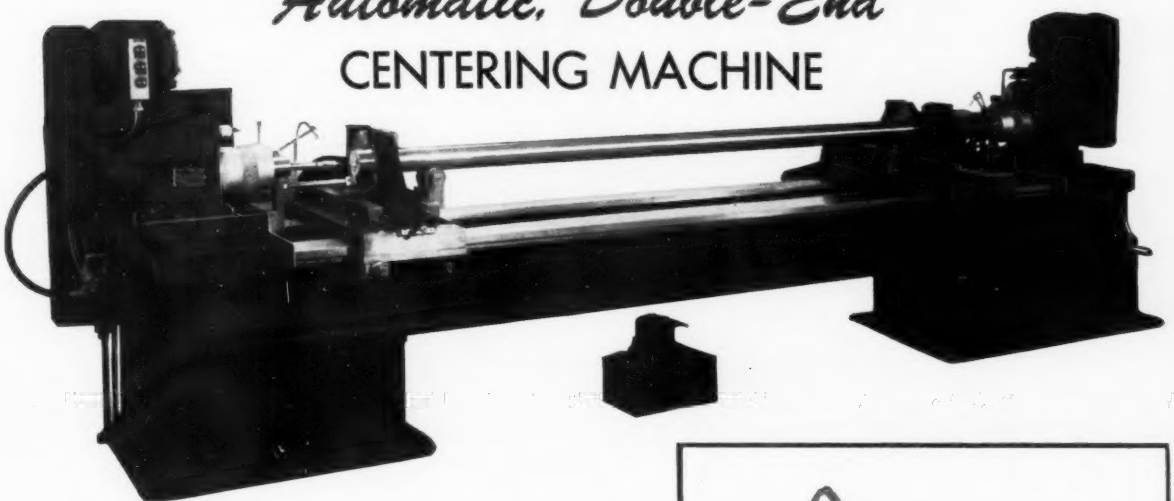
DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago

For more information fill in page number on Inquiry Card, on page 233

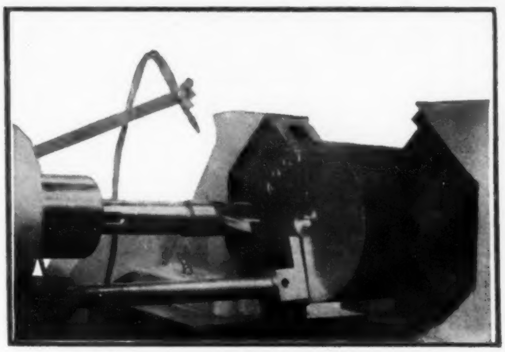
SAVE UP TO TWO HOURS CENTERING TIME PER PIECE On Individual or Short Run Jobs!

with the new Impco *Automatic, Double-End* CENTERING MACHINE



Most work performed in engine lathes is turned and machined on centers. The *method* of centering is a major factor in production economy. In most job-lot and semi-production work, centering is *still* being uneconomically performed in engine lathes. Due to manual operation and multiple handling, *the time consumed is from ten minutes to two hours or more per piece!*

The new Impco Automatic, Double End, Centering machine provides a fast, accurate method of simultaneously centering and spot facing to a controlled length, both ends of 1" to 10" diameter stock. *Machine cycle time is approximately two minutes per piece,* plus only one handling. The standard model accepts lengths up to ten feet and is specifically designed to permit quick, easy "change-over" for individual or short run jobs.

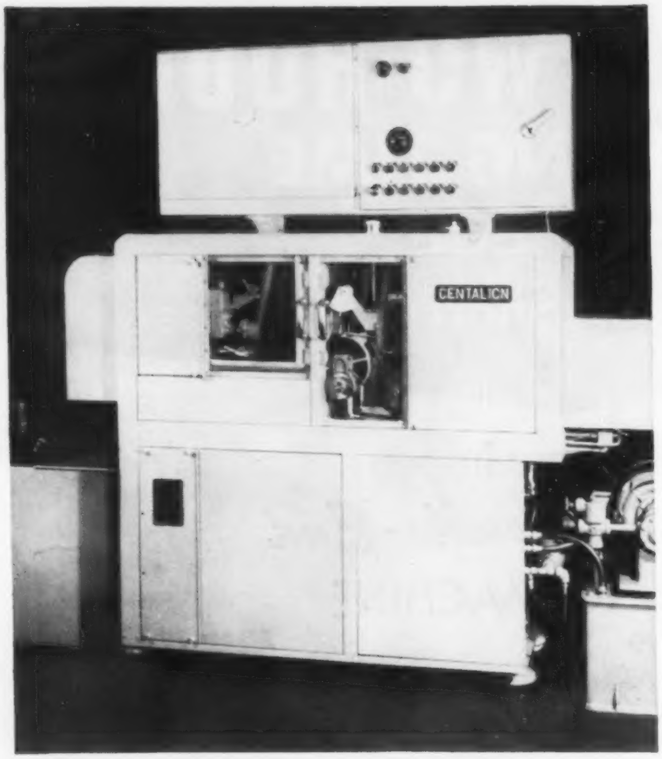


This machine has a definite place in *any* shop having work in the above range. For further information send for Bulletin C-1-957 today.

IMPCO ®

IMPROVED MACHINERY INC.
NASHUA • NEW HAMPSHIRE

For more information fill in page number on Inquiry Card, on page 233



Bryant "Centalign" internal grinder for finishing tapered bearing races. Built for lower cost with welded steel.

LESS WEIGHT... GREATER CAPACITY

Costs cut with welded steel

By taking full advantage of the superior strength and rigidity of steel, engineers of the Bryant Chucking Grinder Company have reduced the cost of this machine base.

Other significant benefits are:

- **Reduced Weight**—26% less.
- **Increased Capacity**—swing of machine increased from 9 to 12 inches.
- **Closer Tolerances**—average size variations from piece to piece on bearing races lowered from 0.00040 to 0.00015 inches and surface finish improved from 21 to 10 micro-inches rms.

These advantages are typical of those being realized by machine tool manufacturers who have designed their product for welded steel. You can attain similar benefits. The Lincoln Electric Company stands ready to assist with your redesign projects.

DESIGN HELPS for engineers and designers

"Procedure Handbook of Arc Welding Design and Practice" new 11th edition, 1300 pages, over 1100 illustrations. Has 240 page section on Machine Design. Price only $3.00 postpaid in U.S.A. $3.50 elsewhere.

Machine Design Seminars conducted regularly at our plant in Cleveland.

Machine Design Sheets sent free to designers and management.

Write to us for full details.

LINCOLN

THE LINCOLN ELECTRIC COMPANY

Dept. [illegible], Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

When welded steel is three times stronger than iron

Has 2½ times the rigidity

Yet costs ⅓ as much per pound

WHY

use anything but welded steel for machine bases?

For more information fill in page number on Inquiry Card, on page 233

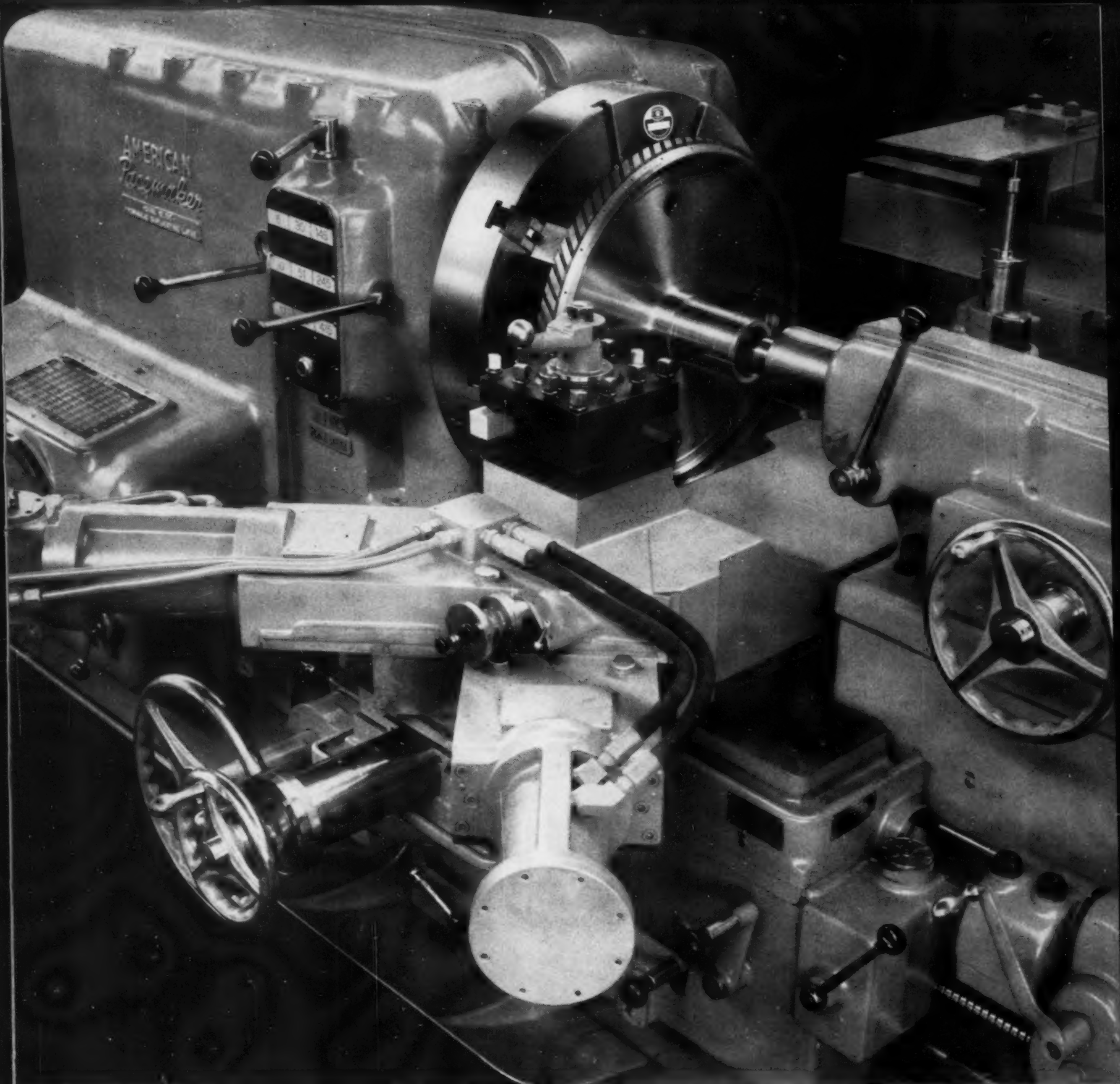


Photo courtesy of The American Tool Works Company

this 140-TON horizontal milling machine

There's never been one like it before!

Just a press of a button puts this mighty Schiess into action. A 25-ft. high column moves smoothly along 45-ft. long bedways. Never a vibration—no chatter—even at maximum transversal loads! The new Schiess design of the spindle heads has eliminated this!

THE MILLING OPERATION. A huge tungsten-carbide cutter in a 14¼" spindle goes to work on the stock. And performs its operation with a consistent accuracy—a surface-finish count—never before obtainable on such a big fellow.

THE BORING OPERATION. Another press of a button! Another spindle goes to work—bores a 79" depth in one cut—or a total depth of 118". Boring and milling spindles are provided with 36 speeds of which the top 12 are V-belt transmitted. Rapid traverse, feeds and manual controls of the two spindles are completely independent.

That this mighty machine has tremendous productive capacity is self-evident. And its productivity goes far beyond conventional milling and boring. Schiess attachments increase its scope to taper-milling, thread-cutting, copying and, in certain instances, copying in 3 dimensions. It's a time saver, too. Can go from feed to rapid traverse immediately, without complicated adjustments.

The Schiess Model FB 36/22.5 Horizontal Milling and Boring Machine is a product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess Engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all five FB models.

also bores and turns

Face milling entire side of 38' x 14' press frame on Schiess Model FB 36/22.5

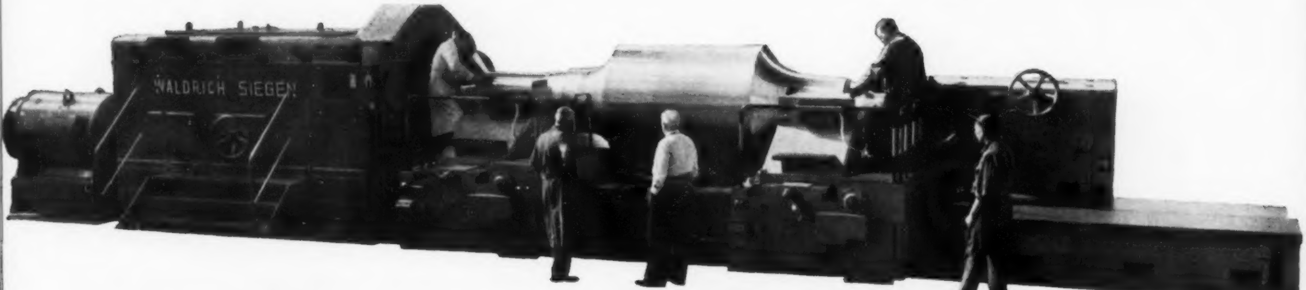
SCHIESS

engineering division

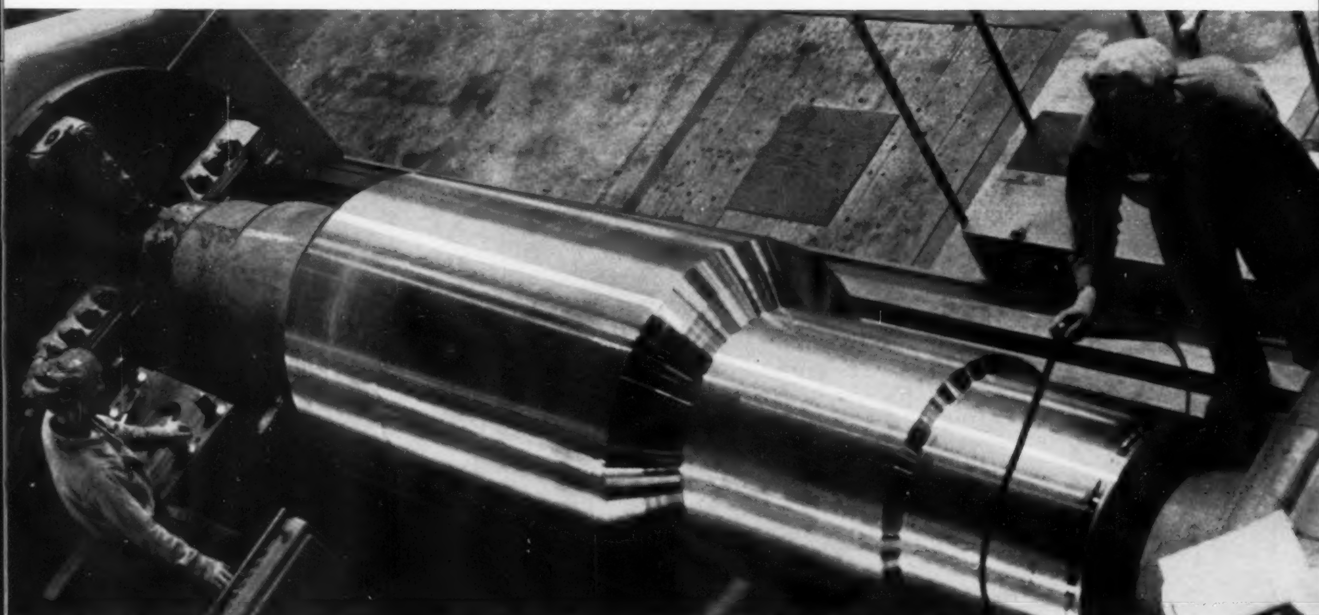
AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

this Waldrich giant



swings a 90-ton roll



—cuts rough turning time 75%

You're looking at the business end of a Waldrich-Siegen Roll Turning Lathe, built to turn a workpiece as long as 30 ft., as fat as 63 in. in diameter, and as heavy as 90 tons!

Right now, you're seeing it in action at the Ohio Steel Foundry Co., Lima, Ohio, biting into a 57-ton, 98-in. long roll, with a 53-in. O.D. In just three passes, its hungry cutters will shear 15 inches of steel off this diameter. Before it's through, 12 tons of turnings will come off.

This job used to take 68 hours at Ohio Steel Foundry. The husky Waldrich breezes through it in just 16½ hours flat.

It takes plenty of muscle to peel through so much steel and the Waldrich has it, delivering 250 horsepower to the spindle. Speed is set at the selector wheel, feed at each of the two independent carriages.

And here's an interesting economy note: chips from the Waldrich lathe are large enough to be remelted, unlike finer chips from other lathes that oxidize too quickly. Ohio Steel Foundry collects a bonus of $15 on every ton salvaged.

Three different size Waldrich lathes are now in operation at this plant, turning workpieces with maximum O.D.'s of 36″, 48″ and 63″. Maybe one of these sizes is the answer to your roll turning needs. It's easy to find out. Write today for complete details on these heavy producers.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA

Announcing THE TOTALLY-NEW LINE OF "BUFFALO" NO. 15 DRILLING MACHINES TAPPERS AND ACCESSORIES

The All-New "Buffalo" No. 15 Drill is packed full of major improvements and superior features . . . all designed to help you speed up production and cut costs.

The completely new design of the No. 15 drilling head achieves an all-time high in operational ease, with these many important advances:

- **Front-Mounted "Start-Stop" Push Button Switch**
- **Easy-to-Read Speed Range Table**
- **Depth Gauge Graduated for Easy Setting**
- **Conveniently-Placed 3-Grip Spindle Feed**
- **Belt Guard Quickly Tilts Upward to Simplify Speed Changes**
- **Motor Bracket Is Hinged, Permitting Step-to-Step Belt-Changing on the Pulleys Without the Use of Tools**
- **Proper Belt Tension Is Automatically Maintained**
- **No Tools Needed for Adjustments of Head or Table**

The newly-designed No. 15 bench and floor bases eliminate grease- and dirt-catching troughs and pockets around the working area. Extremely sensitive for small hole drilling, these new machines are sufficiently rigid and heavy to operate at full capacity without strain or wear.

The new No. 15 line includes bench, floor and pedestal models (bench and pedestal types in 1- to 6-spindle models). Attachments are available for tapping, mortising, routing or spot-facing.

For a demonstration of the amazing new No. 15 Drill, contact your nearby "Buffalo" machine tool dealer. Or, for complete details, write us direct for Bulletin 4024.

All "Buffalo" products feature the famous "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long-life.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

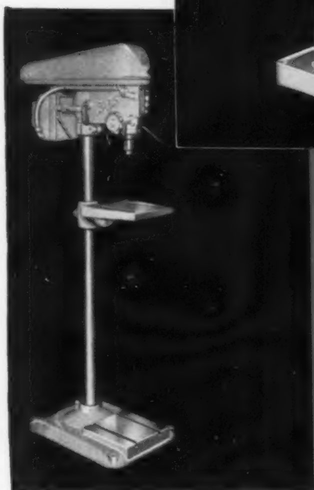
BUFFALO FORGE COMPANY

440 Broadway, Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

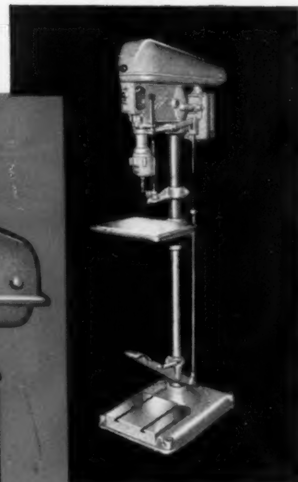
DRILLING PUNCHING SHEARING BENDING

No. 15 Pedestal Type Drill. This sturdy, efficient machine is built for years of dependable service. Recommended for shops requiring higher production and versatility. Available in 1 to 6 spindles. Overall height 75".



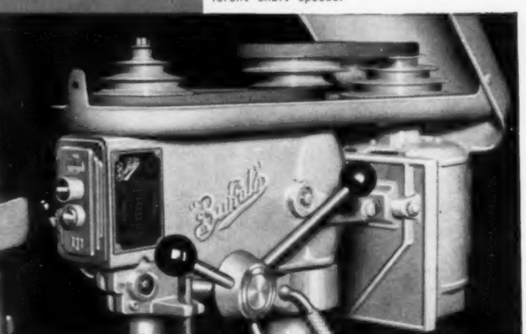
No. 15 Heavy-Duty Floor Drill. Where versatility is a key factor, this model is ideal for a variety of uses in the average machine shop. Over-all height: 68½". 10 x 11" tilting table swivels on 2¾" diam. column. Base is 10 x 10".

No. 15 Tapping Machine. Available in two sizes: No. 0, 3/16" and No. 1, 5/16" capacity. Stripper and tap oiler are provided. Under favorable conditions this unit will give results equal to machines costing many times more.

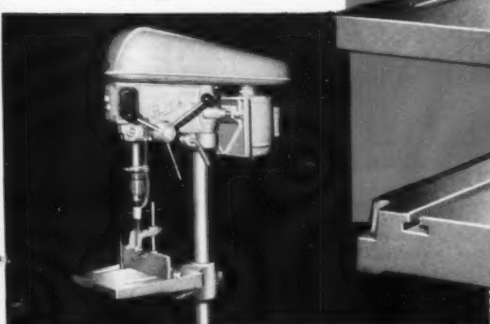


"Buffalo" No. 15 Heavy-Duty Bench Drill

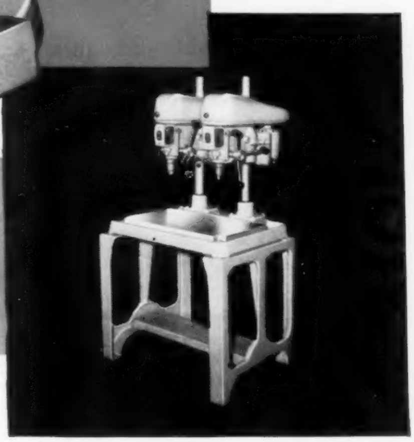
Slow Speed Attachment for No. 15 Drills. Three lower speeds of 112, 210 and 380 RPM are obtained with 60 cycle, 1750 RPM motor. Proportionate speeds with 25 or 50 cycle motors, or those with different shaft speeds.



No. 15 Drill with Mortising Attachment. Attachment fits over chuck. The fence and hold-down are all-metal construction, similar to those on higher priced mortising machines.



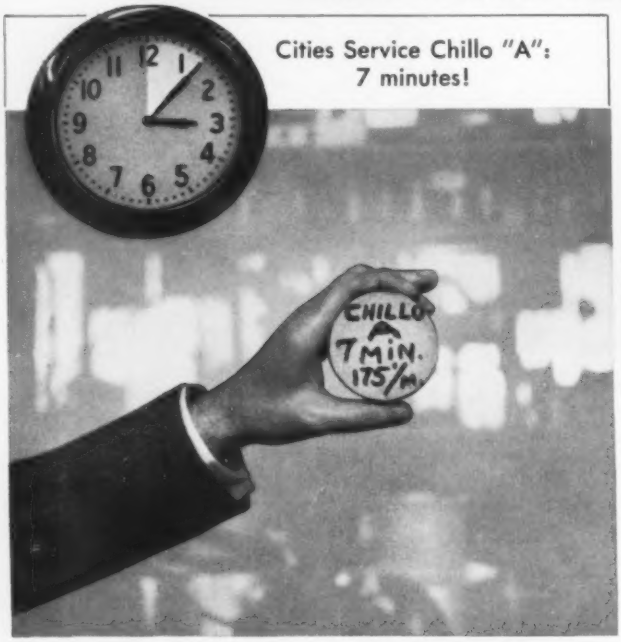
No. 15 Multiple Spindle Bench Drill. Available in 1 to 6 spindles, with or without head-raising device. Working surface of table varies from 14 x 14" for 1-spindle to 14 x 74½" for 6-spindle models.



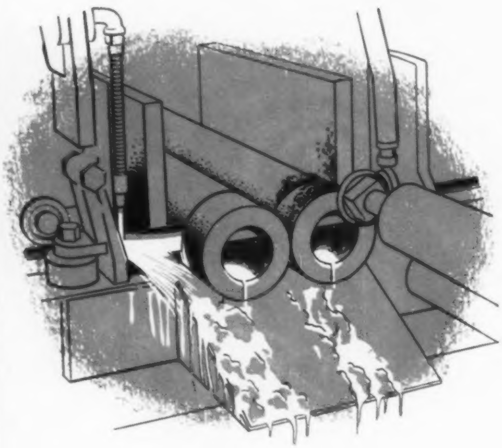
Tough 2½" diameter mandrel at Rc 44 on 1150 ton brass extrusion press. Scovill Manufacturing Co.

Cutting Oil takes the time test

at S. G. Frantz Co., Inc., Trenton, N. J.



Cities Service Chillo "A": 7 minutes!



Competitive brand: 20 minutes!

S. G. Frantz Company decided to keep a truly open mind.

They'd been using Cities Service Chillo Cutting Oil and other Cities Service products for some time with great satisfaction. Still, there was no harm testing Chillo Cutting Oil against another brand just to make sure they were getting maximum results.

But even the people at S. G. Frantz never expected what followed. Using the competitive oil, and a piece of 4130 aircraft rod, 2⅞" in diameter, they made a single cut at saw speed of 175 feet per minute. Time: 20 minutes.

Next, the same test again – but this time with Cities Service Chillo "A" Cutting Oil. Time: 7 minutes! Nearly three times faster!

Using the same material on another job, the Frantz Company found difficulty making clean threads to aircraft standards on a Number 5 Turret Lathe–that is, until Cities Service Chillo 10Z was tried. Right there the problem ended.

"The problem ended." You'll hear it again and again from those who use Cities Service Cutting Oils and lubricants. And perhaps these oils can end a problem for you, too. Talk with a Cities Service Representative. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

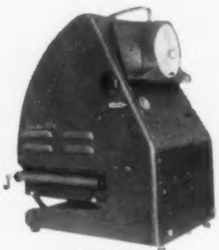
QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 233

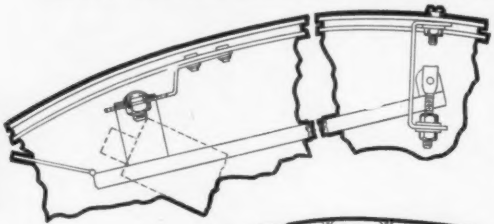
Waldes Truarc Rings cut assembly costs, improve performance of precision photo-optics equipment

Charles Beseler Co., E. Orange, N. J. uses Waldes Truarc Retaining Rings in 3 applications shown.

REFLECTING MIRROR ASSEMBLY IN OPAQUE PROJECTOR



VU-LYTE II PROJECTOR

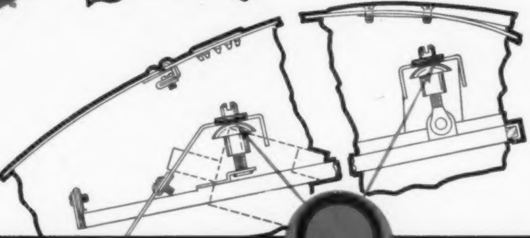


BEFORE

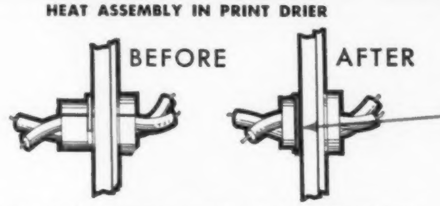
"The front surface mirror is the most precise optical element in a properly-functioning opaque projector," Beseler writes. "Previously we used this extremely cumbersome means of holding the mirror in position. As mirror adjustments are always required and the mirror is extremely delicate, our spoilage was terrific."

AFTER

"Two Truarc Series 5100 Rings made possible complete redesign of the mirror assembly. Now mirrors can be adjusted from *outside* the projector. Rejects now are practically nil. More precise adjustment of the mirror is possible. And because of the greater ease in adjustment, we have cut labor costs $2.00 per unit."

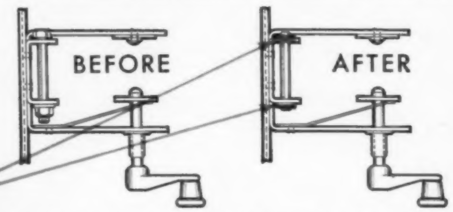


HEAT ASSEMBLY IN PRINT DRIER



Here a Waldes Truarc crescent ring, Series 5103, replaced a split collar and clamping ring. Results: labor costs cut 50¢ per unit because of greater ease of assembly. Drier provides more uniform heating.

35 MM MICRO-FILM NEGATIVE CARRIER IN ENLARGER



2 Waldes Truarc Series 5133 E-Rings replaced 2 cap nuts—at a saving of 20¢ per unit in labor costs.

Whatever you make, there's a Waldes Truarc Ring designed to save you material, machining and labor costs, and to improve the functioning of your product.

In Truarc, you get

Complete Selection: 36 functionally different types. As many as 97 standard sizes within a ring type. 5 metal specifications and 14 different finishes. All types available quickly from leading OEM distributors in 90 stocking points throughout the U. S. and Canada.

Controlled Quality from engineering and raw materials through to the finished product. Every step in manufacture watched and checked in Waldes' own modern plant.

Field Engineering Service: More than 30 engineering-minded factory representatives and 700 field men are at your call.

Design and Engineering Service not only helps you select the proper type of ring for your purpose, but also helps you use it most efficiently. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

WALDES
TRUARC®
RETAINING RINGS
WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send new, descriptive catalog showing all types of Truarc rings and representative case history applications. *(Please print)*

Name ....
Title ....
Company ....
Business Address ....
City .... Zone ..... State ....

M129

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

For more information fill in page number on Inquiry Card, on page 233

Heavy duty machine tools for mechanical, electromechanical siderurgical and metallurgical industries, for shipyards, arsenals and railway shops.

CENTER LATHE T. P. 4

Swing over bed 120" Distance between centers 50' Main motor power HP 180 Weight of the machine 200 Tons Admitted weight on centers 100 Tons

SE

STABILIMENTI
S. EUSTACCHIO s. p. A.
BRESCIA ITALY

No. 6 in a series

THERE'S NO COMPROMISE

You get demonstration of your work and complete job development record

Cone submits samples of your work

Cone makes recommendations

You send print to Cone

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	5/8"
Machine	1 5/8" Conomatic	Hole Dia.	1 1/4"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1 5/8"		

Conomatic

For particulars send for "Four Steps With Cone"

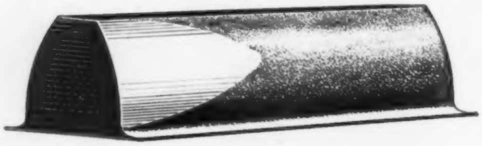
CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

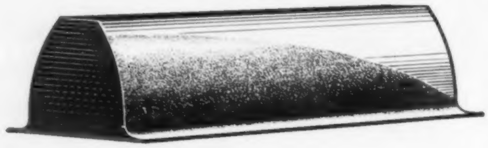
 For more information fill in page number on Inquiry Card, on page 233

Hard Gear Honing .... GIVES YOU BETTER GEARS AT LESS COST

QUICK GEAR INSPECTION

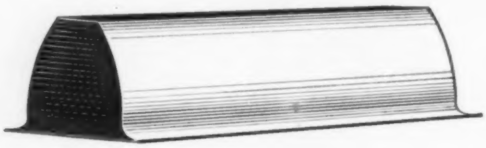
One quick pass with a Red Ring honing tool cleans up the teeth or immediately reveals heat-treat distortions, thus indicating corrective adjustments in the gear forming processes.





CORRECTION OF HEAT-TREAT DISTORTIONS

Minor distortions in tooth profile, helix, index and runout are corrected in from 15 to 60 seconds of honing time.



IN ADDITION

Gear honing provides:

- The Lowest Cost Remedy for Nicks and "Hickies"
- Improved Tooth Surface Smoothness
- Overall Sound Improvement

For Quality Gear Production, write for Bulletin H57-2 which gives the full story on Red Ring Hard Gear Honing.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

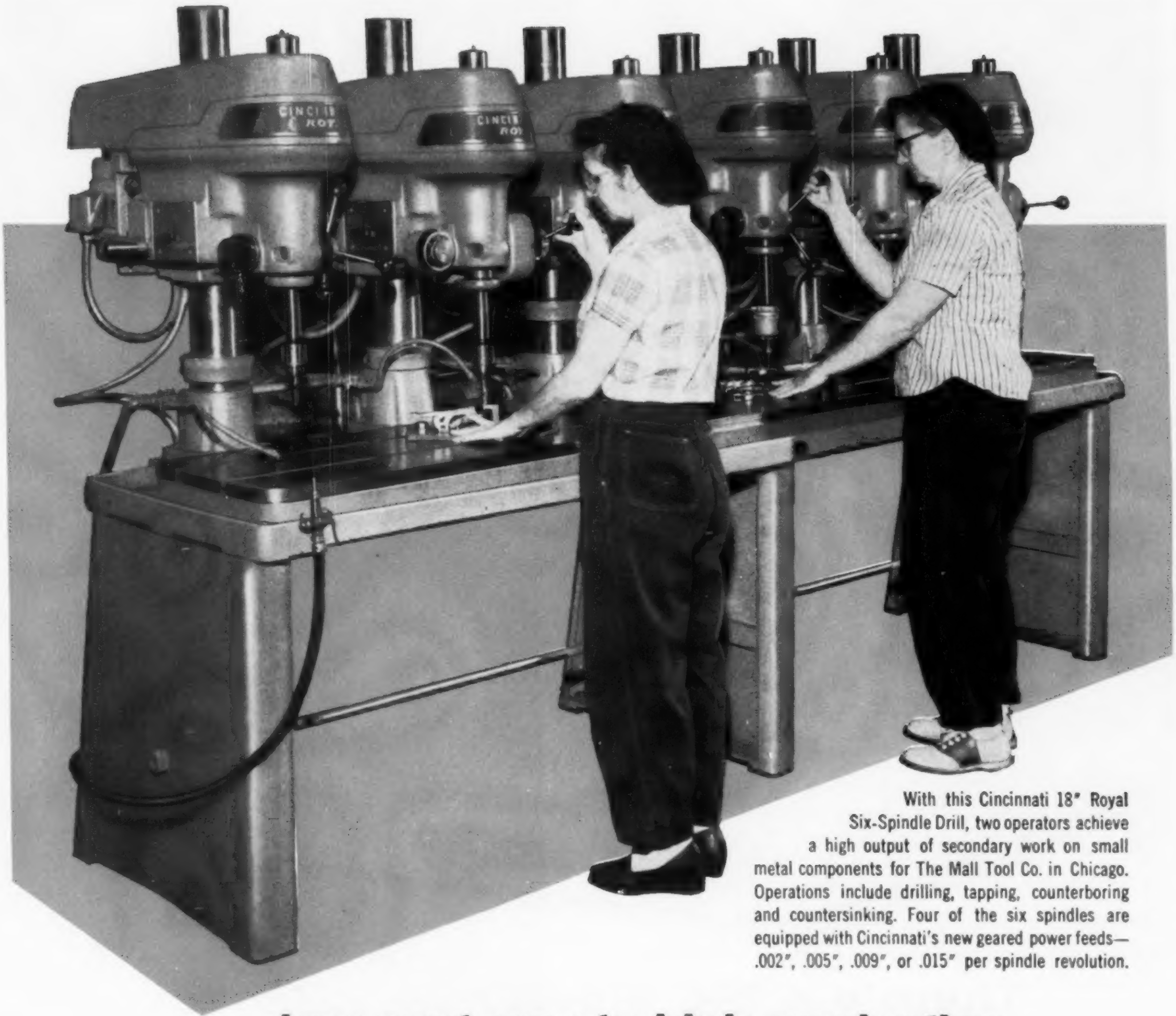
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

7875

WORLD'S LARGEST PRODUCER OF GEAR SHAVING MACHINERY

For more information fill in page number on Inquiry Card, on page 233



With this Cincinnati 18" Royal Six-Spindle Drill, two operators achieve a high output of secondary work on small metal components for The Mall Tool Co. in Chicago. Operations include drilling, tapping, counterboring and countersinking. Four of the six spindles are equipped with Cincinnati's new geared power feeds—.002", .005", .009", or .015" per spindle revolution.

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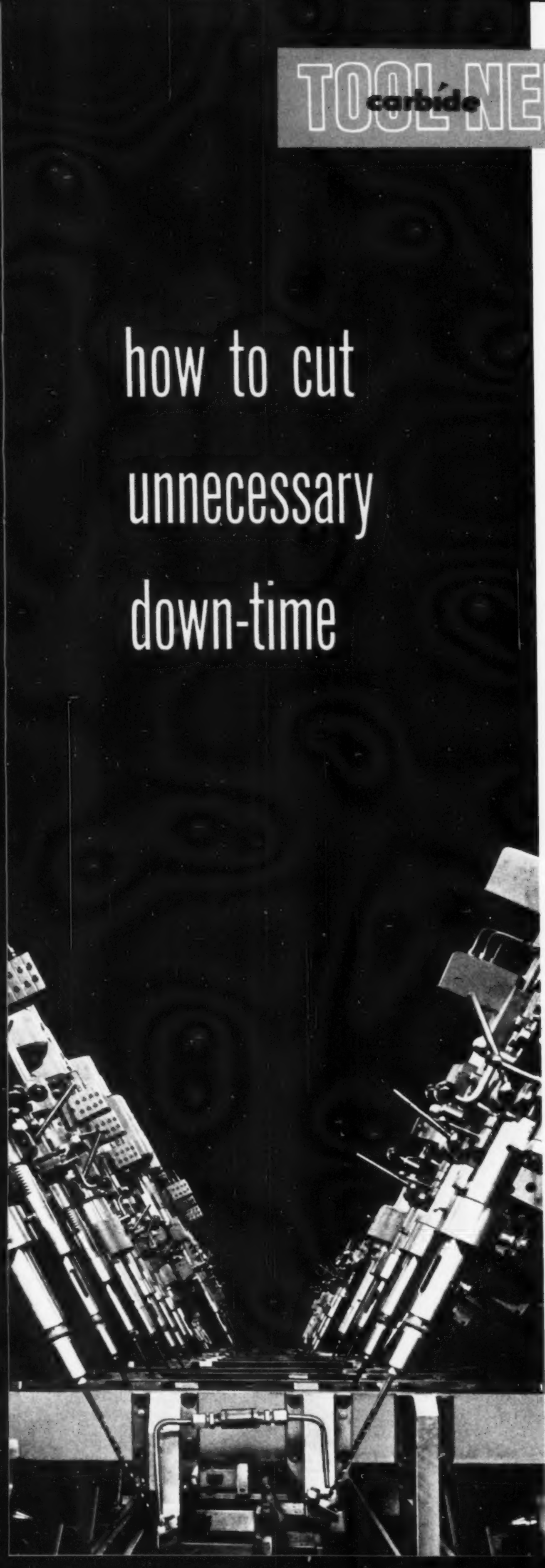
TOOL carbide NEWS

These suggestions are condensed from Issue #3 of Wesson's publication, "PRODUCTION LINE".



how to cut unnecessary down-time

You can't eliminate *all* machine down-time. Machines do need maintenance and the best of tools can't stay sharp forever.

BUT—

You can eliminate most UNNECESSARY down-time—and it is the unpredictable and unintentional down-time that usually costs the most.

Three main causes of avoidable down-time are: Tool failures, too rapid tool wear, and excessive set-up time.

To minimize these causes we suggest the following as being well worth remembering in selecting, testing, applying, specifying and procuring tools:

For any given job, there is always ONE SPECIFIC carbide grade that is BEST.

Tool Failure

Except for the occasional accident due to hard spots, excess material, momentary power failure, etc., tool failures can be avoided by good tool practices.

The so-called "equivalent" or comparison charts for carbides are deceiving. Time and again, one carbide will stand up on a job while "equivalent" grades break down rapidly. Increase in life of 3 to 1 and 6 to 1 and even more are not un-

(Continued on next page)

WESSON Throw-away Tooling Combines Operations

TOOL NEWS **carbide**

PRODUCTION LINE #3

If you would like a copy of this publication, just jot down your name and title on your company letterhead and mail it to: Editor, PRODUCTION LINE, at the address below.

tools Wesson
carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

With **WESSON** "throw-away" tooling, you can cut the number of separate operations on a part by combining several in a single tool assembly. The reasons:

1. Sharpening of complex tools is eliminated
2. Tool-change time is cut way down
3. Ingenious tool designs let you use throw-away inserts in more places
4. Wessonmetal carbides give long life between "tool changes".

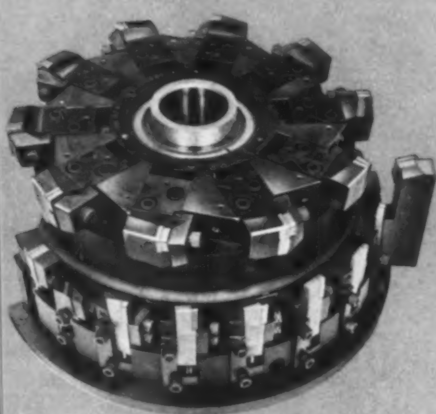


FIG. 1

FIG. 1—An example of how separate operations are eliminated by combining tools. This cutter does the lion's share of the work in producing brake-drums for a prominent 1958 car. The twenty tools include six single point brazed tools with screw adjustment, and 15 throw-away insert types. They rough bore the entire drum, chamfer it, plunge cut a face on the OD and a cooling groove between ID and OD.

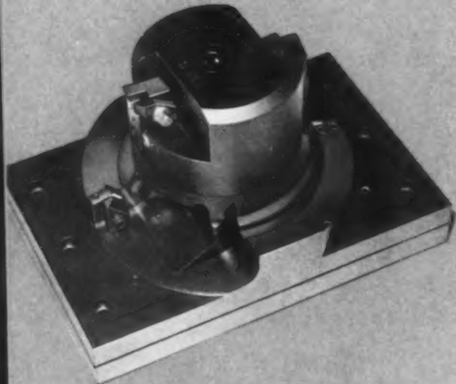


FIG. 2

FIG. 2—Just four identical throw-away tips, ½ inch square, plus one diamond shaped throw-away tip in this tool do all these things on large special pipe couplings: (1) taper bore; (2) relieve; (3) face the end; (4) chamfer the ID; (5) chamfer the OD. Combining these in a single tool has tripled productivity.

FIG. 3

FIG. 3—Inside a well-known automatic transmission, there is a band-retainer housing with an internal hub. To bore the housing, turn the OD of the internal hub, chamfer the part and counterbore the hub, only one operation is needed. Only one tool is used—a WESSON Multicut boring head. The turning and chamfering tools for the internal hub are micro-adjustable. The entire design is made possible by throw-aways.

FIG. 4

FIG. 4—There are two opposed triangular Wessonmetal throw-away tips on this tracer-controlled Multicut boring bar. They profile bore the entire complex ID of a turbine part. One tip cuts going in. The other cuts coming out. Both are micro-adjustable for rapid initial set up.

How to cut unnecessary downtime

(Continued from previous page)

usual. The decrease in down-time for tool changes is in proportion of course.

Tool Life

The same factors hold true for tool wear. Time and again tests show even so-called equivalent grades varying as much as 2: and 3:1 and up, in pieces per grind—without any variation in feeds, speeds, depth of cut, etc.

Obviously on-the-job tests are an important factor in specifying the *best* carbide grade for the job.

Set-up Time

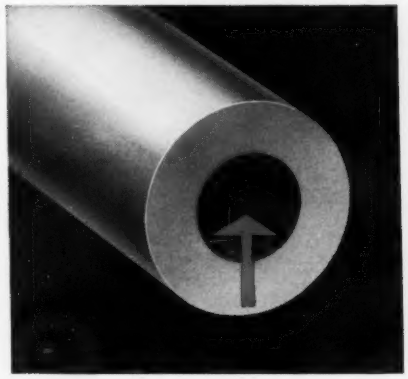
When tooling up, it pays to consider what type of tool will give you minimum set-up time when changing tools. Frequently **WESSON** throw-away tooling will cut down-time enormously. When tool change is necessary you release the insert with a twist of a hex wrench. Index the insert to a new cutting edge. Clamp it with another twist of the wrist. You're ready to go—with the least possible machine time lost.

How to do it

To cut unnecessary down-time, what is needed is a plant-wide cost reduction program that seeks to cut down-time through improved tooling practices.

You can simplify and speed such a program in your plant. Wesson's unique in-plant-engineering service has never yet failed to produce major cost reductions. The same service is available without cost to you on a plant-wide program basis.

Litho in U.S.A.



a hole here is a hindrance... a hole here is a help

Crucible Hollow Tool Steel sections, cut to length, save you time and money when you make ring-shaped, or tubular parts, or tools with a center hole. Because these tool steel sections are already drilled through when you get them, you don't have to bore, drill, cut-off or rough-face. Production time goes down, and most scrap losses are eliminated.

Five popular grades of Crucible tool steel are available immediately from warehouse stock, in hollow-disc form. They are KETOS oil-hardening, SANDERSON water hardening, AIRDI 150 high-carbon, high-chromium, AIRKOOL air-hardening, and NU-DIE V hot-work tool steels. Order the O.D. and I.D. combination, and length and thickness you need.

Let your Crucible representative show you how hollow tool steel sections can reduce production time, and save you money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE **first name in special purpose steels**

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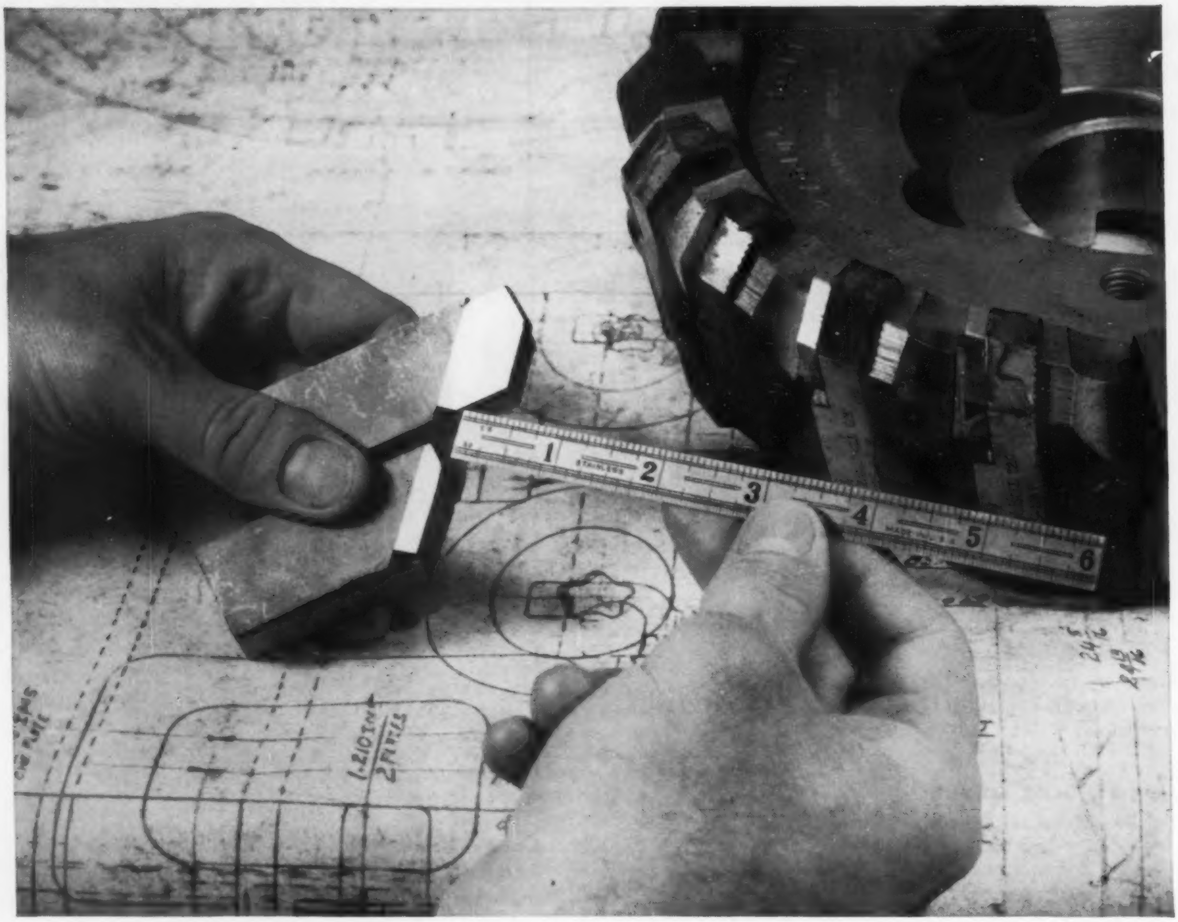

Ingersoll Heavy-Duty Shear Clear Face Mill designed for cast iron or steel. Size of bevel is varied to suit depth of stock.

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Do you get over ½" of blade wear? A look into your scrap barrel will show that many blades were wasted because of cracks, misuse, improper design or misapplication of the cutter and grade of carbide. You probably can't tell why these blades failed prematurely because so many variables are involved.

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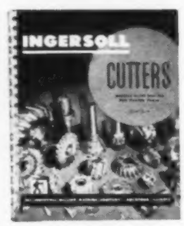

If you do not have a copy of this book, write us and we will send you one. It describes in detail the complete line of Ingersoll inserted blade milling and boring tools. Ask for Catalog #668

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TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

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- **Sputnik Appraised**
- **Uniform Leasing Rules**
- **Business as Usual**

Keeping up with Washington

Loring F. Overman

PERHAPS it was fortunate that Congress was in recess when Sputnik emitted its first startling beep-beeps. First reactions to the news were these: "Who goofed?" "Let's invest new billions in a crash missiles program." "The economy program threatens national security." "Off with somebody's head."

By the time Congress convenes in January, tempers will have cooled, and near-panic will have yielded to a calm appraisal of the situation. Present indications:

> Hoped-for tax reductions in 1958 are unlikely, since the future defense budget might exceed the present $38,000,000,000 ceiling.
>
> Current defense budget will again be reviewed to place greater emphasis on missiles.
>
> Elimination of inter-service rivalry in the missiles development will become a major objective of the Administration.
>
> Recent directives trimming appropriations for basic research will be restudied.

Sputnik's advent may have rendered many conventional weapons as obsolete as the crossbow and may have a deep impact on the machine-tools-for-defense program. Decisions have to be reached regarding the type and number of weapons that will be needed and the kind of machine tools on which they can be made best. To help with these problems, the machine tool industry has a new spokesman in the Business and Defense Services Administration. He is Arvid O. Lundell, president of the Colonial Broach & Machine Co., Detroit. Mr. Lundell will serve for six months without compensation as adviser to the director of the Metalworking Equipment Division of the BDSA.

Uniform Leasing Rules

Amendment 3 to Defense Mobilization Order VII-4 sets up a long-awaited set of guidelines applying to the leasing of government-owned machine tools to private industry. Issuance of the guidelines is the second step in a program recommended by an interagency task group, in consultation with industry representatives. The new guidelines cover term of lease, purchase option, renewal option, maintenance, installation charges, transportation and removal costs, rebuilding and overhauling costs, and type of rental consideration contemplated.

Legislation which would eliminate one of the major points of difference between industry and the services on the question of rental payments has been introduced by Senators Sparkman (D-Ala.) and Thye (R-Minn.). Now pending before the Senate Armed Services Committee, the bill would authorize payment of rental fees for machine tools into a revolving fund within each government agency owning them. Payments would be earmarked for the replacement of aging or obsolete equipment. Machine tool people may wish to inform their senators of their wishes in this matter.

Of particular interest are the general considerations stated in the official text of Amendment 3 to DMO VII-4:

1. Government lessor agencies should not be regarded as being in the leasing business as an end in itself, in the same sense as private establishments.
2. Government-owned production equipment should not be leased before it has been established that the machine tools needed are not available from private sources.
3. Rental rates and leasing guidelines outlined do not apply to wholly-owned government facilities operated by private contractors on a cost-plus-fee basis.
4. Agencies providing government-owned production equipment to private contractors shall insure that no contractors are afforded a favored competitive position thereby.
5. Such exceptions as from time to time may be necessary to the policy outlined herein shall be made only with prior ODM approval.

Business as Usual

- Atomic Energy Commission is seeking proposals for preliminary studies on compact nuclear reactor systems for military use. Qualified firms are invited to inform the Schenectady Operations Office, P.O. Box 1069, Schenectady, N. Y. Purpose of the studies is to determine which concepts show greatest promise for use in mobile power plants (up to 2000 kilowatts), for extreme compactness, and for low operating weight.
- Ease-up on credit curbs may be near, according to a recent memo of a Congressional Joint Economic Committee. In summing up the outlook for the balance of 1957, the Committee reported that business purchasing of plants and equipment is apparently leveling off. If this trend continues, the memo indicated, monetary officials should be ready to shift from a policy of restraint to one of easier money.
- Despite Sputnik, there are senators who still believe that federal expenditures can be cut. Senator William E. Jenner (R-Ind.) has observed, "Our task is not cutting out bits of waste here and there. It is the high political task of dismantling the spending agencies . . . . We can cut over-spending in three ways: . . . on foreign affairs . . . on national affairs . . . on activities which the Federal Government should never have undertaken."

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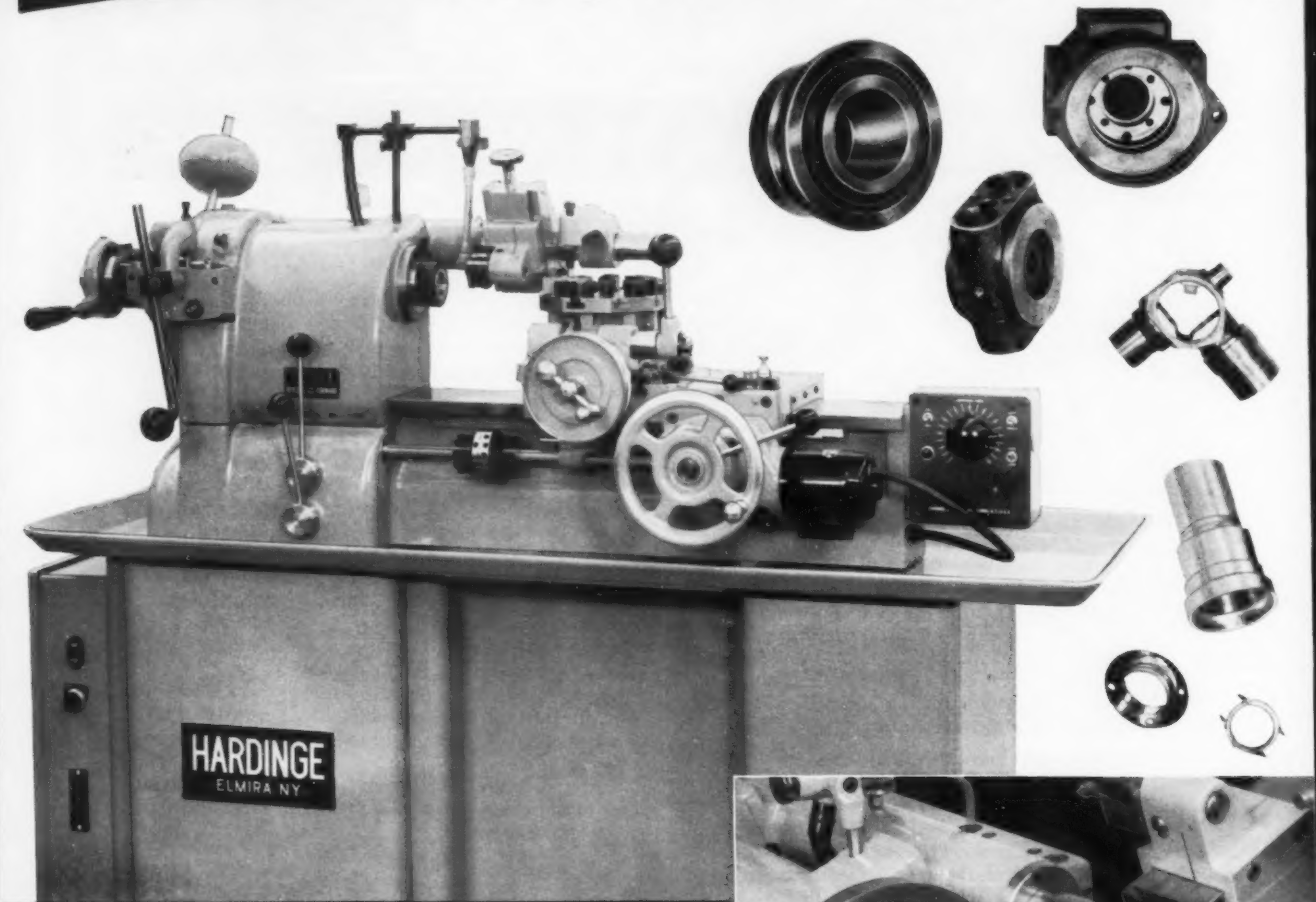

Users enthusiastically tell us how they can easily maintain close tolerances, get better parts finish, and at the same time substantially cut costs . . . when they put Hardinge High Speed Precision Chucking Machines to work.

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The Automobile Industry Prepared for 1958

WHEN IT COMES TO automobiles no one really likes to be driving an obsolete model. The showing of new cars is, therefore, always awaited with considerable interest on the part of the general public. This is the season for the introduction of the 1958 models. They have been announced by the press and in many cases have appeared in showrooms and on the streets.

While appearance exerts a major influence in the selection and purchase of automobiles, mechanical features are increasingly important. Consequently, manufacturers strive to turn out cars that they consider ultra in their price class with regard to both looks and performance. From these two viewpoints the new cars will be substantially different from last year's models.

Whenever changes in car designs are involved, money must be spent for new dies and tooling, for machine tools and other fabricating equipment. It has been estimated that the automobile industry invested one billion dollars in new production machinery and tooling for the 1958 cars. Progressive, as always, the industry has purchased the most advanced equipment that is available on the market today.

Mechanized manufacture or automation has been increased in planning to meet next year's requirements in as efficient and economical a manner as possible. Retooling is expensive, but competition is tough, and the industry cannot afford to produce with out-of-date machinery or methods.

Some of the advanced manufacturing processes adopted in various plants of the automobile industry for turning out the new cars are described in this Annual Automotive Number. While developed specifically for one industry, many of the principles involved could be applied toward the elimination of uneconomic practices in other branches of the metalworking industries.

Charles O. Herb

EDITOR

2351

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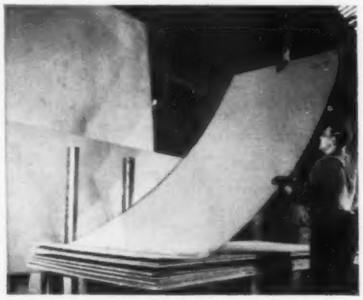
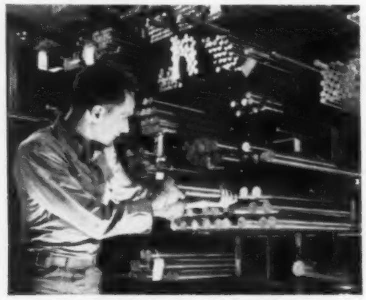


STAINLESS PLATES—Nine analyses, including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.



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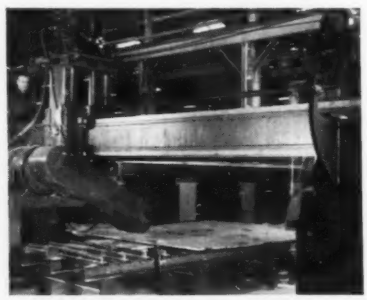
STAINLESS CIRCLES, RINGS, SPECIAL SHAPES—No matter how intricate, we can flame-cut practically any shape from stainless steel plate. One piece or a thousand.



TRUE-SQUARE ABRASIVE CUTTING—Stainless plates up to 12′ x 25′ cut absolutely square on abrasive disc machine. Length and width tolerance plus or minus 1/32″.

Principal products: Carbon, alloy and stainless steel — bars, structurals, plates, sheets, tubing, industrial plastics, machinery and tools, etc.

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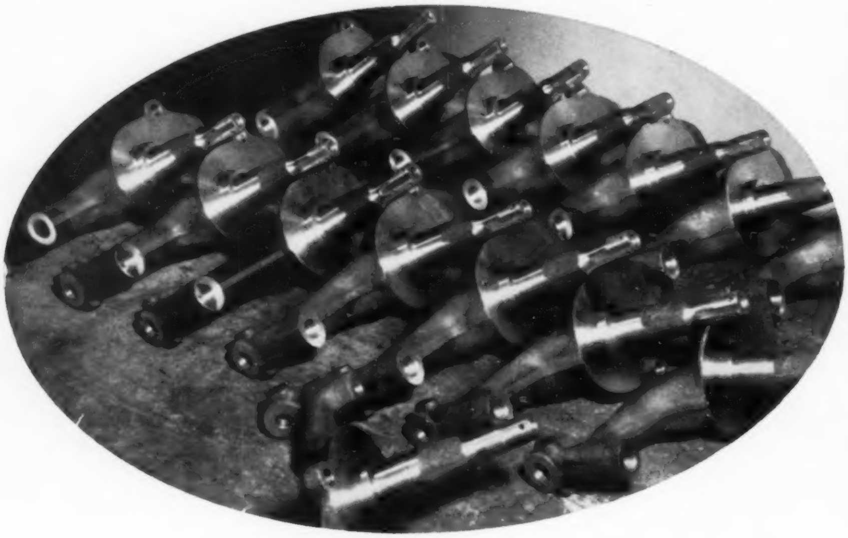
Photo, courtesy Buick Motor Division, General Motors Corporation

1958 AUTOMOTIVE PRODUCTION

Vol. 64 No. 4 MACHINERY December 1957

Machining PONTIAC'S New Steering Knuckle

LEWIS B. ARSCOTT
Assistant Master Mechanic
Pontiac Motor Division
General Motors Corporation
Pontiac, Mich.



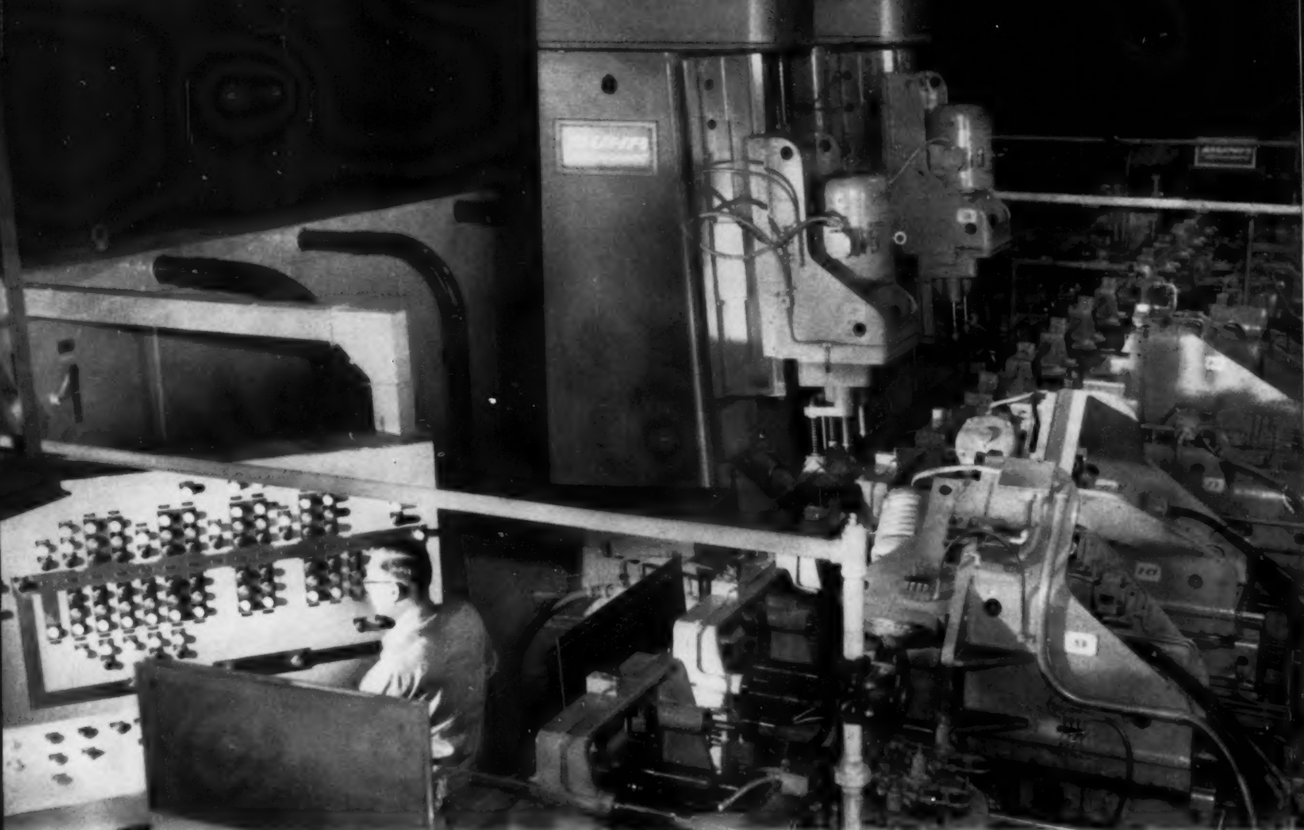
STEERING KNUCKLES for the ball joint suspension systems on 1958 Pontiacs have been redesigned to combine the knuckle and support member. The knuckles are forged from SAE 1345 steel. After inspection, the forgings are heated to 1550 degrees F. in a continuous gas-fired furnace, quenched in oil, and drawn to produce a Brinell hardness of 241 to 286.

Both the yoke and stem ends of each steering knuckle are spot-faced and center-drilled on a Seneca Falls Lo-swing double-end centering machine. The forging is secured by toggle clamps actuated by an air cylinder. High-speed steel center drills are employed, while the spot-facing tools are tipped with Tantung. The tools are rotated at 652 rpm and fed at the rate of 0.006 inch per revolution.

Center-drilled and spot-faced forgings are dropped on conveyors which carry them to stock tubs. At this location the stems are turned and the flanges faced on Seneca Falls electromechanical tracer lathes. The operator places the forging on the headstock center, centering the lugs on the knuckle yoke between the dogs on a headstock driver assembly. Then the air-operated tailstock is actuated to push the work-piece into the driver, compress the spring-loaded center, and locate the forging endwise.

When the operator presses the machine cycle button, a spindle-positioning stop is relieved and a switch energized to start the main drive clutch. An air cylinder on the vertical tool-slide moves the two carbide insert facing tools toward the work along a 6-degree angle from the vertical. Another air cylinder actuates a clamping mechanism which locks the facing tool block in cutting position. Then the tools are fed at the rate of 0.011 inch per revolution while a constant cutting speed of 300 feet per minute is maintained by means of a General Electric variable-speed drive unit. At the completion of the facing cuts, the second air cylinder releases the clamping mechanism, and the first cylinder retracts the block away from the work at a 6-degree angle to relieve the tools. About 0.060 inch of stock is removed by the square carbide insert which faces the flange and the triangular carbide insert which faces the hub.

Then contour-turning of the stem and finish-facing of the flange are performed by a diamond-shaped carbide insert mounted on the front angular tool-slide. Movements of the tool, at a feed rate of 0.022 inch per revolution, are regulated by a template mounted on top of the tailstock (Fig. 1), and a patented Senaca Falls electromechanical control system. The system contains a displacement transducer and template stylus mounted on a micrometer-adjusted base.



The transducer has built-in switches for sensing both initial actuation and overtravel of the stylus. An electronic amplifier and a mechanical torque amplifier complete the system. The mechanical amplifier takes its power from a constantly revolving shaft and moves the tool in accordance with the original sensing signal.

From 0.060 to 0.090 inch of stock is removed per side in contour-turning the steering knuckle stem and about 0.015 inch in finish-facing the flange. When the tracer tool has completed its traverse, the clutch on the machine spindle is disengaged, a brake is engaged, and a torque motor is energized. This torque motor takes over the drive (turning the spindle at 26 rpm), and after a short delay, a spindle stop is swung into position. A collar on the spindle contacts a pin on the stop, thus actuating a switch which deenergizes the torque motor. The spindle is now in the proper position for loading the next part. When the operator retracts the tailstock center, the machined knuckle is ejected from the driver by the spring-loaded headstock center.

Forgings are inspected for possible cracks on a Magnaflux unit, and after demagnetizing, are placed on a conveyor which carriers them to powerized rotary hoppers, 9 feet in diameter. Here operators place the steering knuckles between centers on angular wheel-head grinding machines made by the Landis Tool Co., Fig. 2, in order to finish the two spindle bearing surfaces, the oil-seal contact surface, and three blending radii. As seen in Fig. 3, the two bearing surfaces must be held to a total tolerance of 0.0005 inch, and the grinding operation is further complicated by the need for a compound radius between the larger-diameter bearing surface and the oil-seal surface—as shown in the enlarged view in the circle.

The wheel-head is set at an angle of 30 degrees and carries two abrasive wheels—one 27 11/16 inches in diameter by 1 1/4 inches wide, and the other, 30 inches in diameter by 1 1/2 inches wide. Aluminum oxide abrasive wheels of 30 grain size and S grade are used to remove from 0.008 to 0.012 inch of stock in one pass. The machines are equipped with a hydraulic straight-infeed mechanism, and a cam-controlled overhead wheel dresser that is traversed hydraulically and has an automatic diamond feed.

Upper ball-stud bosses on the steering knuckles are finished, lower ball-stud bosses are semi-finished, and qualifying pads are broached on Colonial 15-ton, 66-inch stroke, dual-ram broaching machines. The bosses on both sides of the ball studs are broached by a total of 346 teeth on the left-hand ram, while the pads are machined with tools mounted on the right-hand

Fig. 1. Template shown mounted on top of tracer lathe tailstock controls movement of contour-turning tool in machining steering knuckle stem.

ram, as seen in Fig. 4. The rams travel at 35 feet per minute, removing 0.060 to 0.090 inch of stock from each surface and leaving about 0.020 inch of stock on the lower ball-stud bosses for subsequent removal in a transfer machine.

Machining of the steering knuckles is completed on either of two identical Buhr sixteen-station transfer machines. One of these hydraulic machines is seen in the heading illustration.

Each of the Buhr transfer machines completes all of the operations required on the steering knuckles—successively drilling, milling, threading, reaming, deburring, spot-facing, chamfering, and tapping the parts as they are indexed from station to station. The installation is unique in that it is one of the few applications of transfer machines capable of performing such operations on steel forgings at production rates up to 221 per hour. Similar operations performed on previous design steering knuckles required twelve separate machines, each with an individual operator.

The work-pieces are manually loaded—two parts into each pallet type fixture—at the first station. Automatic clamping is accomplished by means of three Ingersoll-Rand air-motors equipped with stud drivers, Fig. 5. A two-spindle drill-head is provided on the right-hand side of the machine at the second station for drilling a cotter-pin hole 5/32 inch in diameter through each steering knuckle spindle. The drills are rotated at 979 rpm (40 surface feet per minute) and fed at the rate of 0.0031 inch per revolution.

When the knuckles have been indexed to the third station, Fig. 6, the lower faces of both up-

Fig. 2. Spindle bearing surfaces, oil-seal contact surface, and blending radii are finished on this two-wheel angular-head grinding machine.

per and lower ball-stud bosses are finish-milled. For this operation a two-spindle left-hand head is equipped with 7 1/2- and 8-inch diameter cutters, each having twenty-six tungsten-carbide inserted blades. The cutters rotate at 102 rpm, providing a cutting speed of 200 feet per minute and are fed at the rate of 0.110 inch per revolution. Simultaneously, a two-spindle left-hand head having two probes is advanced to insure that the cotter-pin holes have been drilled in the parts at the previous station.

Holes 33/64 inch in diameter are drilled through the upper ball-stud bosses, and two more cotter-pin holes 5/32 inch in diameter are drilled through the steering knuckle spindles by tools on the left- and right-hand heads, respectively, at Station 4. The boss-hole drills revolve at 398 rpm (54 surface feet per minute) and are fed at the rate of 0.0078 inch per revolution. A right-hand probe head at the fifth station checks the cotter-pin holes.

Jones & Lamson die-heads are mounted on the two-spindle right-hand head at Station 6 to chase 3/4-20 threads on the steering knuckle spindles. A feed rate of 0.050 inch per revolution is employed with the die-heads rotating at 127 rpm (25 surface feet per minute). The left-hand head at the sixth station is used to drill 1/2-inch diameter holes through the lower ball-stud bosses.

Anchor pin bosses on the right-hand side of the steering knuckles are milled at Station 7. End mills 3 inches in diameter and having ten tungsten-carbide inserted blades are rotated at 255 rpm and fed at the rate of 0.050 inch per revolution to remove about 0.018 inch of stock from these surfaces. A left-hand head at this same station is tooled to core-drill 5/8-inch diameter holes

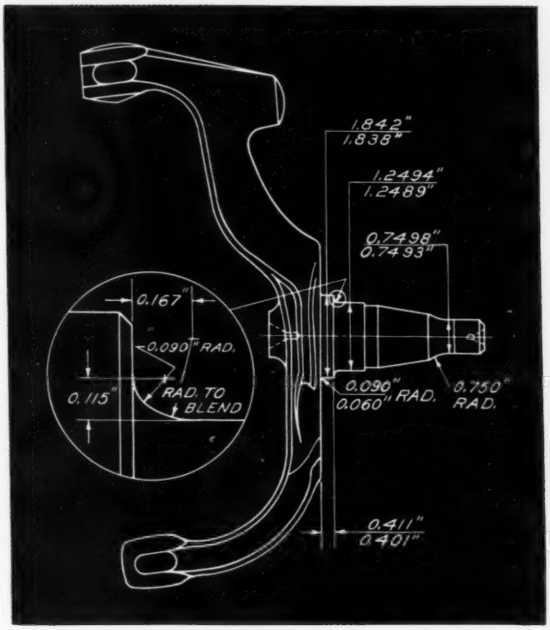


Fig. 3. Surfaces finished on grinding machine shown in Fig. 2. Enlarged view in circle indicates compound radius required between bearing and oil-seal surfaces.

through the lower ball-stud bosses. These drills are fed at 0.0178 inch per revolution and revolve at 247 rpm (20 surface feet per minute).

Station 8 is idle and has been provided to accommodate tooling that might be required to take care of possible future design changes in the knuckle. A keyway is milled in each knuckle spindle by tools on the right-hand head at the ninth station. Both upper and lower ball-stud

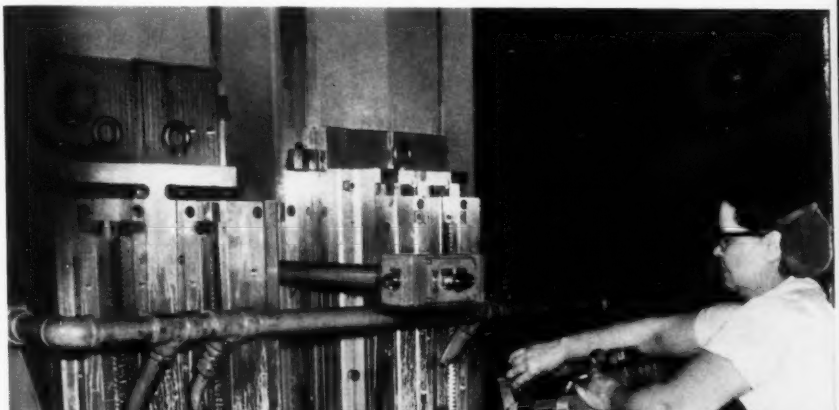
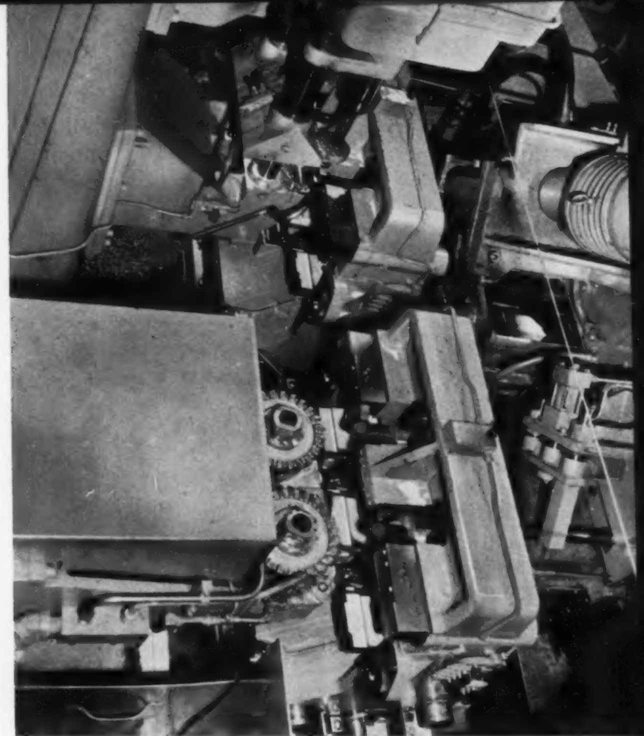


Fig. 4. Dual-ram, 15-ton broach for machining upper and lower ball-stud bosses, as well as the qualifying pads on the steering knuckles.



holes are rough-taper-reamed with tools on the left-hand head at this station.

Finish-taper-reaming of the upper and lower ball-stud holes is done at Station 10, with the left-hand head. The right-hand head, Fig. 7, has two Osborn wire-wheel brushes, 6 inches in diameter (having 0.008-inch diameter wires impregnated in rubber), for removing burrs from the threads and keyways. The brushes are rotated at 3474 rpm in one direction as they are fed toward the work at 18.72 inches per minute, and in the opposite direction as they are retracted.

Station 11 is idle and at the twelfth station anchor stud holes are drilled to a diameter of 0.5156 inch and a depth of 0.90 inch for subsequent tapping. Also, two flange holes 0.460 inch in diameter are drilled through each steering knuckle. The anchor stud holes and the two flange holes in each part are chamfered, and two bosses are spot-faced by tooling on the right- and left-hand heads at Station 13. Combination spot-facing and chamfering tools, each having six tungsten-carbide teeth, are used for this operation. These tools are rotated at 230 rpm (120 surface feet per minute) and are fed at the rate of 0.008 inch per revolution.

At the fourteenth station, seen at the lower left in Fig. 8, the anchor stud holes are probed and

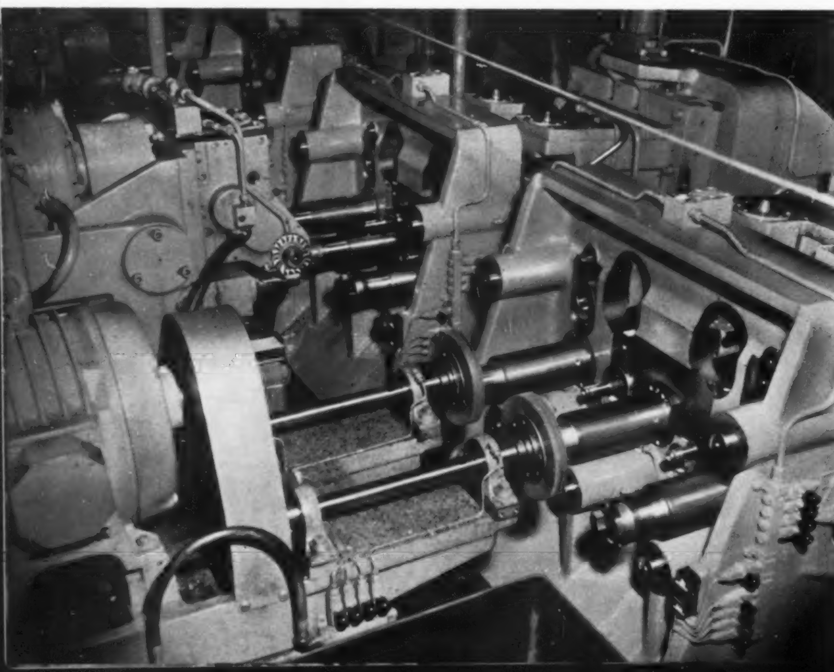


Fig. 5. (Above left) At loading station of transfer machine, knuckles are automatically clamped in pallet type fixture by means of air-motor-powered stud drivers.

Fig. 6. (Above right) View of third station (foreground) and fourth station (top) of the sixteen-station transfer machine seen in heading illustration.

Fig. 7. (Left) Wire-wheel brushes on the right-hand head at the tenth station are used to remove burrs from threads and keyways. Keyway cutters can be seen at preceding station.

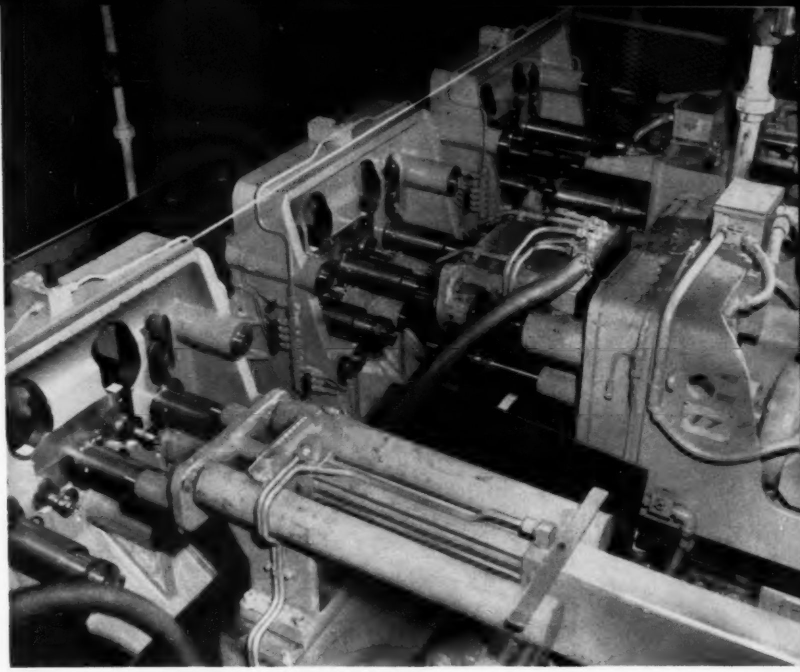


Fig. 8. Anchor stud holes in steering knuckles are probed and blown out at Station 14 (lower left) prior to tapping at fifteenth station (center).

blown out prior to tapping at Station 15 (shown at the center). The taps are fed at the rate of 0.0555 inch per revolution, while revolving at 170 rpm (25 surface feet per minute). Tungsten-carbide-tipped step reamers are also mounted on the right-hand head at this same station for reaming the two flange holes in each part to a diameter of 0.460 inch.

Ingersoll-Rand reversible air-motors with stud drivers are also provided on the right-hand head at Station 16 for automatically unclamping the completed work-pieces. On the left-hand side of the machine at this position, a Pontiac designed automatic unloading unit has been provided. This air-operated, limit-switch-controlled unit consists essentially of work-supporting centers on reciprocating arms. When the arms have been advanced to the pallet type fixture, the centers are fed outward to enter the ball-stud holes. Then the knuckles are retracted from the fixtures, rotated 90 degrees, and dropped on a conveyor.

A total of twenty-one pallets are provided on each transfer machine. An automatic lubrication unit supplies oil to the bearing surfaces as every tenth pallet passes the unit on the machine. Unloaded pallets are automatically shuttled at right angles to the direction in which they have been transferred, until they reach a parallel chain conveyor, Fig. 9. This conveyor carries them through a washer and returns them to the loading end of the transfer machine.

After being washed, the steering knuckles are given a final inspection, and acceptable parts are sent to final assembly.

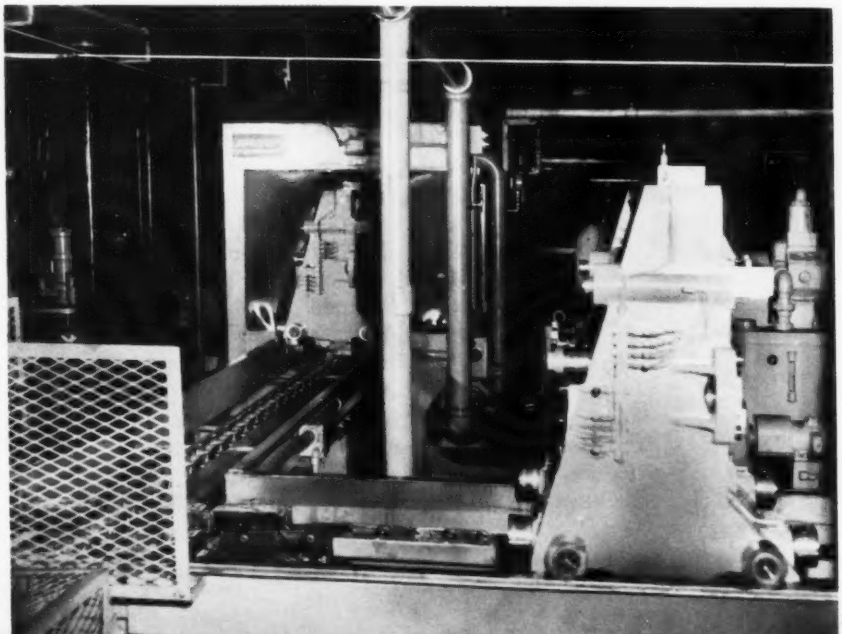
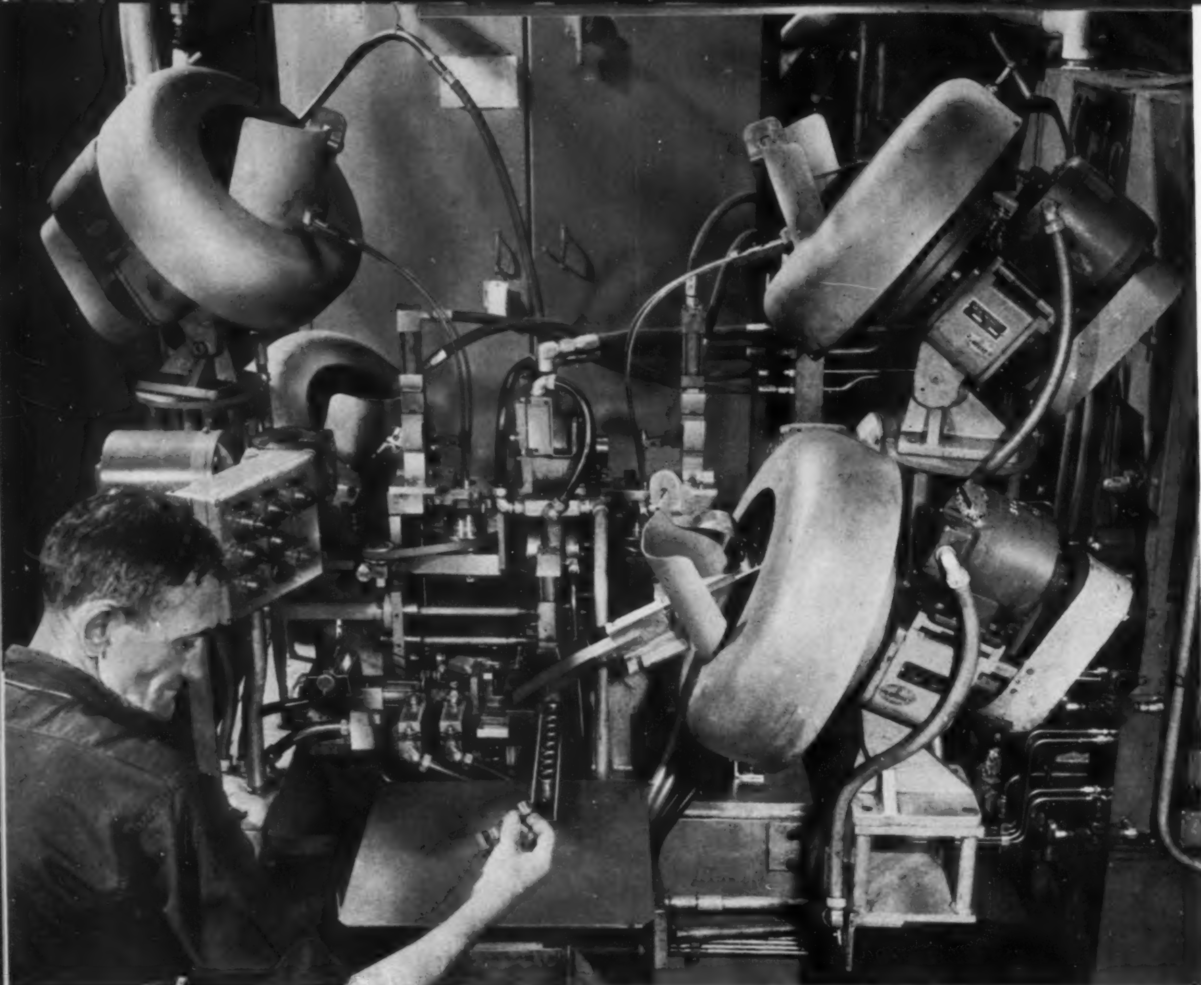


Fig. 9. Empty pallet type fixtures are shuttled to chain conveyor that carries them through washer and returns them to the loading station.



FORD Speeds Output of Needle Bearings

FORD MOTOR CO.'s new chassis parts manufacturing plant in Sterling Township, eighteen miles north of downtown Detroit, offers many striking examples of advanced production techniques. About three million pounds of raw material in the form of forgings, castings, bar stock, and sheet steel are used per day to produce newly designed, more complicated automotive parts in greater volume and with improved quality.

Complete rear-axle and differential assemblies, drive shafts, and ball-joint front suspension assemblies are among the components shipped to twenty Ford car and truck assembly plants in fourteen states. One of the smallest yet extremely important assemblies produced is the universal-joint needle bearing. Severe service requirements —the transmission of the full engine horsepower to the rear wheels—dictate the need for precise tolerances and exacting quality standards. Also, the fact that eight bearings are required per car necessitates mass-production methods.

Output of universal-joint needle bearings at

Needle bearings are a critical link in the automotive power train—transmitting all of the engine horsepower to the rear wheels through the universal joint. Production of these precision components has been increased and their cost reduced by unusual methods.

CHARLES H. WICK
Managing Editor

the Ford Sterling plant has been boosted by adopting improved processing—a combination of cold-extrusion and automated machining and assembly operations.

Races for the needle bearings are made from SAE 1010 steel, hot-rolled, pickled, and oiled. Slugs are blanked, eleven at a time, from 12-inch wide by 10-foot long and 0.385-inch thick steel sheets on a Verson 400-ton press operating at twenty strokes per minute. The blanking punch is 0.990 inch in diameter, and the die, 1.090 inches in diameter. Prior to extruding, the slugs are washed, pickled (to roughen their surface), and coated with a film of dry lubricant. This Parker Rust-Proof Co. process consists of a hot caustic wash, hot rinsing, an acid pickle, a cold rinse, hot rinsing, the Bonderite treatment, another cold rinse, a Parcolene rinse, application of the lubricant by dipping in a liquid, and draining.

Cold-Extrusion of the Bearing Races

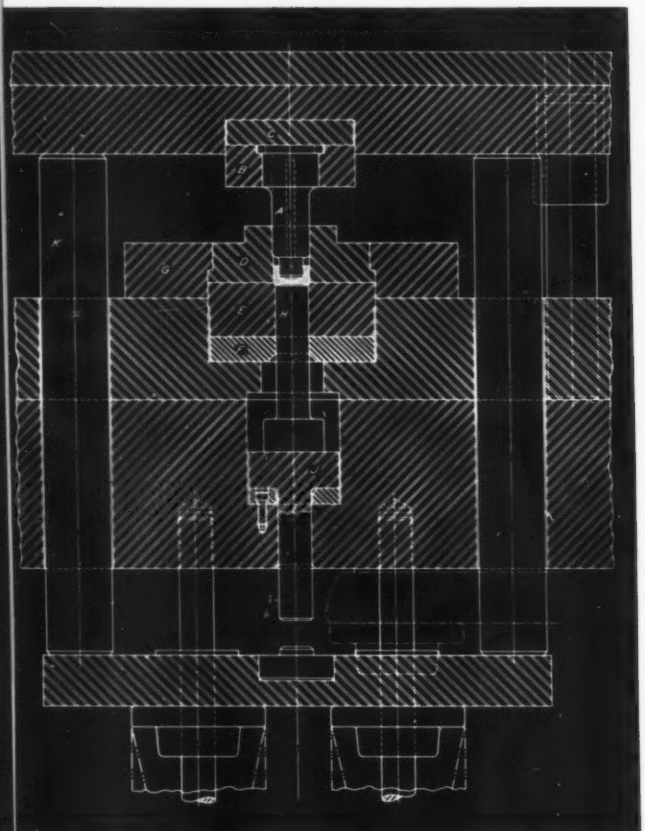
Cold-extruding of the needle-bearing races is done on a Bliss 200-ton press, Fig. 1, operating at thirty-five strokes per minute and equipped for magazine feeding and automatic unloading. The operator merely keeps the vertical tubular stacker on the front of the press loaded with slugs. A pusher arm, actuated by an air cylinder having a 2 1/2-inch diameter bore and 2-inch stroke, slides a slug from the bottom of the stack with each press stroke. A horizontal line of fourteen slugs extends between guide plates from the stacker to the die. As each slug is fed from the stacker, the slug at the opposite end of the line is pushed into extruding position between spring-loaded fingers.

A cross-sectional drawing of the cold-extrusion die is shown in Fig. 2. Extruding punch *A* is made from high-speed steel (SAE D-2), hardened to about 61 Rockwell C and ground. This punch is secured to the upper die-shoe by a retainer ring *B* and backed up by a plate *C* made from an oil-hardening tool steel having a hardness of 61 Rockwell C. Draw-ring *D* is also made from high-speed steel and hardened to 61 Rockwell C. The draw-ring is mounted on a support member *E* and backup plate *F*, both made from oil-hardening tool steel and having a hardness of 59 Rockwell C.

The draw-ring is secured to the lower die-shoe by a clamp ring *G*. Knockout pin *H*, made from high-speed steel and hardened to 59 Rockwell C, rests on a spring-loaded bottom punch *J*. Pres-

Fig. 1. Races for needle bearings are cold-extruded from slugs on this magazine-loaded, 200-ton press at the rate of thirty-five strokes per minute.

Fig. 2. Cold-extrusion die used on the press seen in Fig. 1. Enlarged views of a slug and extrusion are shown encircled at the bottom.



sure pins *K*, made from cold-rolled steel, are cut to length at assembly to provide a dwell of 0.75 inch before punch *J* and pin *H* knock out the completed extrusion. Approximately 60,000 bearing races can be extruded before regrinding is necessary, and the die can be reground about six times before it must be replaced.

All green machining operations required on the extruded bearing races are completed on an Acme-Gridley six-spindle chucking machine, seen in Fig. 3. Finished parts are automatically ejected onto a chute from the fifth position on the machine by means of a pusher-bar mounted in the spindle. Simultaneously, an extrusion is loaded into the collet from a Feedall hopper and shuttle assembly by a loader head mounted on the machine tool-slide.

At the sixth position, the bore of the extrusion is chamfered with a knee-turner holder and tool bit mounted on the main tool-slide. Also, the periphery is broken down by a dovetail toolholder and form tool on the cross-slide. Another dovetail form tool is mounted on the cross-slide at the first position for cutting the external fillets to the required radii. A counterboring tool on the tool-slide at this same position faces the bottom of the race bore. This bottom face is undercut with another tool-slide-mounted counterbore at Position 2.

An angular fixture and tool bit is mounted on the tool-slide at the third position for recessing the bore. Finally, the bottom face of the bore is finished, and the race is faced to length by means of a counterboring tool on the tool-slide at Position 4. The work-pieces are rotated at 2156 rpm,

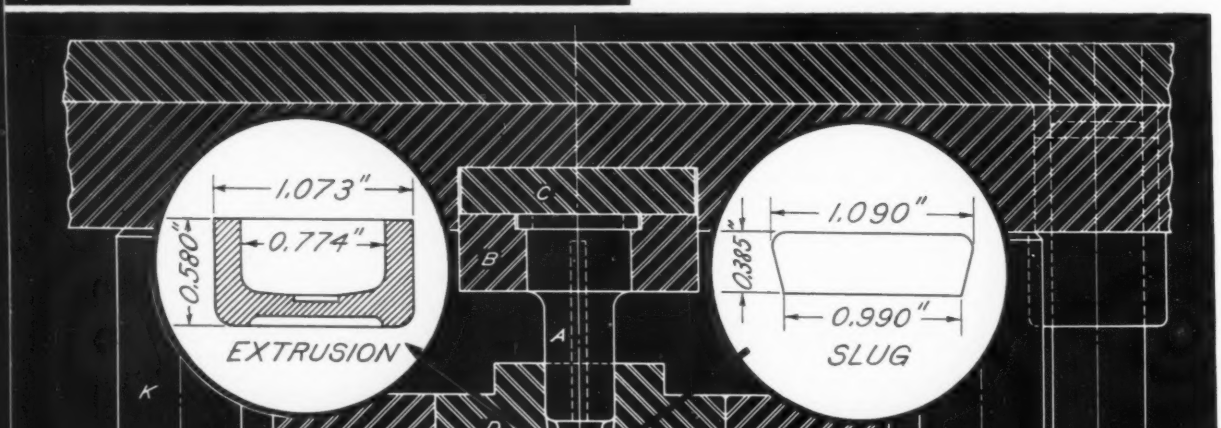


Fig. 3. Extruded bearing races roll down chute (upper right) from hopper and are automatically loaded in collets by head mounted on tool-slide. This six-spindle chucking machine completes all of the green machining operations required, and automatically ejects the finished parts onto a chute.

providing a maximum cutting speed of 610 surface feet per minute. The main tool-slide is fed at the rate of 0.003 inch per revolution; the form tool at the sixth position, 0.0044 inch per revolution; and the form tool at the first position, 0.0022 inch per revolution. All tools are tungsten-carbide-tipped except for the recessing tool, which is Stellite. Cycle time is only one and eight-tenths seconds, giving a production of 2000 bearing races per hour.

Bearing races are then carburized, quenched, washed, and drawn to provide a hardness of 59 to 64 Rockwell C, with a case 0.030 to 0.040 inch deep. Carburizing is done in a Surface Combustion controlled-atmosphere, continuous rotary furnace. Heat-treatment requires a ten-hour cycle per part.

Races are Ground Automatically

About 0.010 inch of stock is removed from the extruded diameters of the races by passing the parts through three Cincinnati centerless grinding machines, Fig. 4. Approximately 0.005 inch of stock is ground off in the first machine, and the same amount in the second. The third pass is simply for cleanup and spark-out. A total tolerance of 0.0003 inch is maintained in this operation, grinding the races to an outside diameter between 1.0630 and 1.0633 inches. KDI automation equipment, Fig. 5, is employed to automatically load the centerless grinders and to transfer the parts between successive machines.

Bryant internal grinding machines, such as the one seen in Fig. 6, are used to finish the bores of the bearing races to a diameter between 0.7845 and 0.7855 inch, removing 0.0095 to 0.0125 inch of extruded stock. Simultaneously, the bottom face of the bore is bump-ground, removing a maximum of 0.004 inch from this surface. The minimum diameter of the bore must be within 0.170 to 0.230 inch of the open end of the race in order to form a crowned bore, and a surface finish of 16 micro-inches is specified. Also, the bore must be concentric with the periphery within 0.001 inch total indicator reading.

Races are distributed to the eleven internal grinders by KDI automation equipment and chutes. At each machine a pick-up arm having loading fingers swings the work-pieces into position, one at a time, and loads them into the chuck. Location is controlled by the swinging arm load-

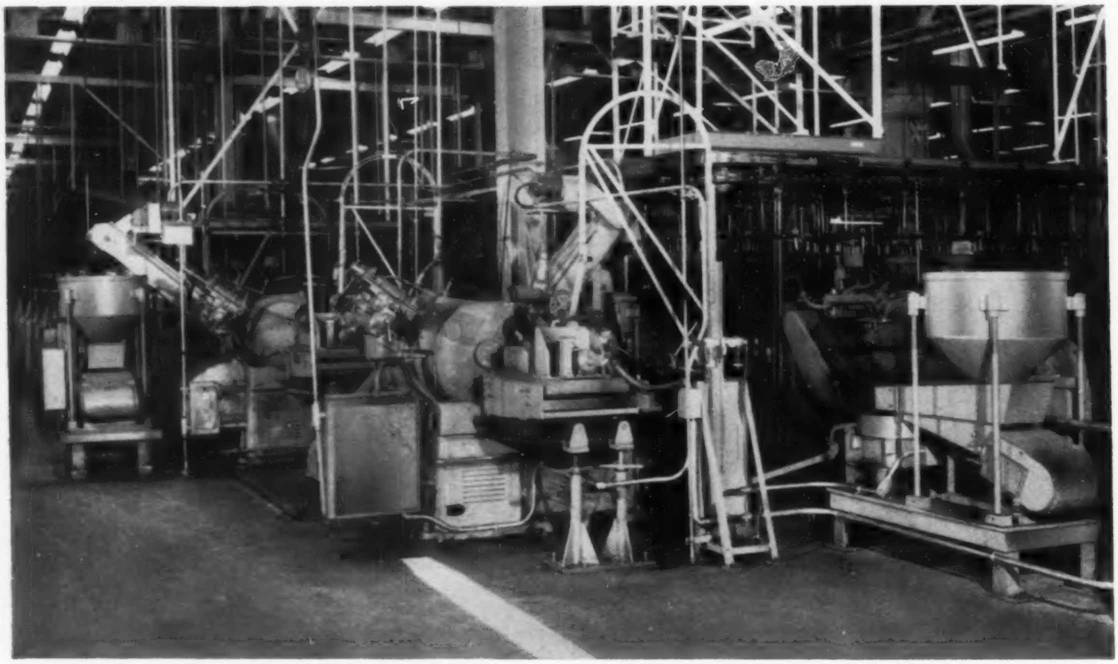


Fig. 4. Outside diameters of races are reduced to between 1.0630 and 1.0633 inches by passing the parts through three centerless grinding machines.

ing to a pre-set depth and no positive stop is used. Ground parts are automatically ejected onto an unloading chute. Each of the grinders is capable of completing 290 races per hour.

Outer back faces of the bearing races are rough- and finish-ground on a Blanchard double-spindle grinding machine, Fig. 7. Parts are automatically loaded onto split plug locators mounted on the magnetic chuck of the machine. From 0.006 to 0.010 inch of stock is ground from the surface, holding the dimension (thickness) to the inner back face to a tolerance of plus or minus 0.0005 inch. The races are automatically unloaded as they pass from under the finish-grinding wheel.

Front, open-end faces of the races are finish-ground on a Blanchard single-spindle grinding machine, with the parts being automatically loaded directly onto the rotary table. From 0.003 to 0.015 inch of stock is removed in a single pass

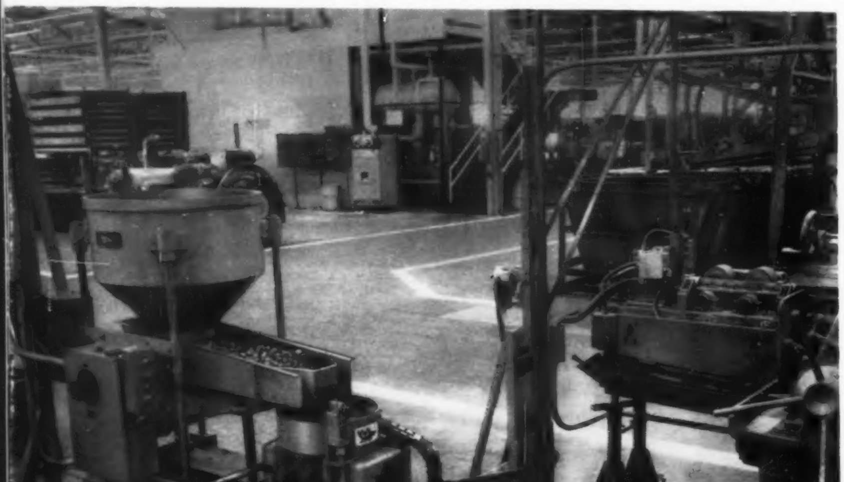


Fig. 5. Automatic loading of the centerless grinding machines (Fig. 4) is accomplished with vibratory hoppers, chutes, and elevating units. Grinder is at right.

Fig. 6. Pivoting pick-up arm transfers bearing races, one at a time, from the vertical loading chute (top) to the chuck of this internal grinding machine.

below the abrasive wheel. Completed races are automatically unloaded and fed through a demagnetizer and washer. After a final inspection, the races are ready for assembly into universal-joint needle bearings.

Automatic Assembly of Rollers and Dust Caps

Completely automatic assembly of twenty-three needle type rollers and a synthetic rubber dust cap to each universal-joint bearing race is accomplished on machines such as the one seen in the heading illustration made by Trio Tool Co. Details of the machine are presented in Fig. 8, and a close-up view is shown in Fig. 9. Needles are held against the race by adhesion from a film of grease applied to the race prior to assembly of the needles. Each machine has four rotary type hoppers—the two upper hoppers for feeding needles; the front lower hopper for supplying caps; and the rear lower hopper for loading the races.

Races, dumped into the hopper at random, are automatically selected with their open sides facing up and are fed down a chute into the first station of a hydraulically operated transfer bar. When a race has been transferred to the second station, a predetermined amount of grease is applied to the race bore. This is accomplished with a metering valve assembly and nozzle mounted on a hydraulically operated slide that is automatically lowered into position and retracted as

Fig. 7. Needle bearing races are automatically loaded on this double-spindle machine which rough- and finish-grinds the outer back face of the parts within plus or minus 0.0005 inch.

required. When in position, the valve opens, and a measured amount of grease is forced through a series of holes in the nozzle.

Station 3 of the automatic assembly machine is idle to provide accessibility to the needle loading station—Station 4. To provide a faster cycle, two needle-collection and assembly units are used. These units cycle alternately, so that each unit loads every other race.

From the hopper, needles slide down two plastic tubes *A*, seen at the left in Fig. 8, and enter bushings *B* in a jaw-retainer plate *C*. A multiple-lobe cam-ring *D*, driven by a belt and pulley from a gear-reduction motor drive unit, periodically moves the two spring-loaded, pivoting jaws *E* outward—thus permitting needles to drop into the jaws. When the cam lobe passes and the jaw returns due to spring pressure, a needle drops into a hole in the cam-ring.

Needles in the cam-ring are free to drop into an escapement ring *F*. However, when the escapement ring is filled and two additional sets of needles have been loaded into the cam-ring, pawls *G* (fastened to the bottom of the jaw) con-

Fig. 8. Front and side sectional views of one of two identical needle-collection and assembly units employed on needle-bearing assembly machine.

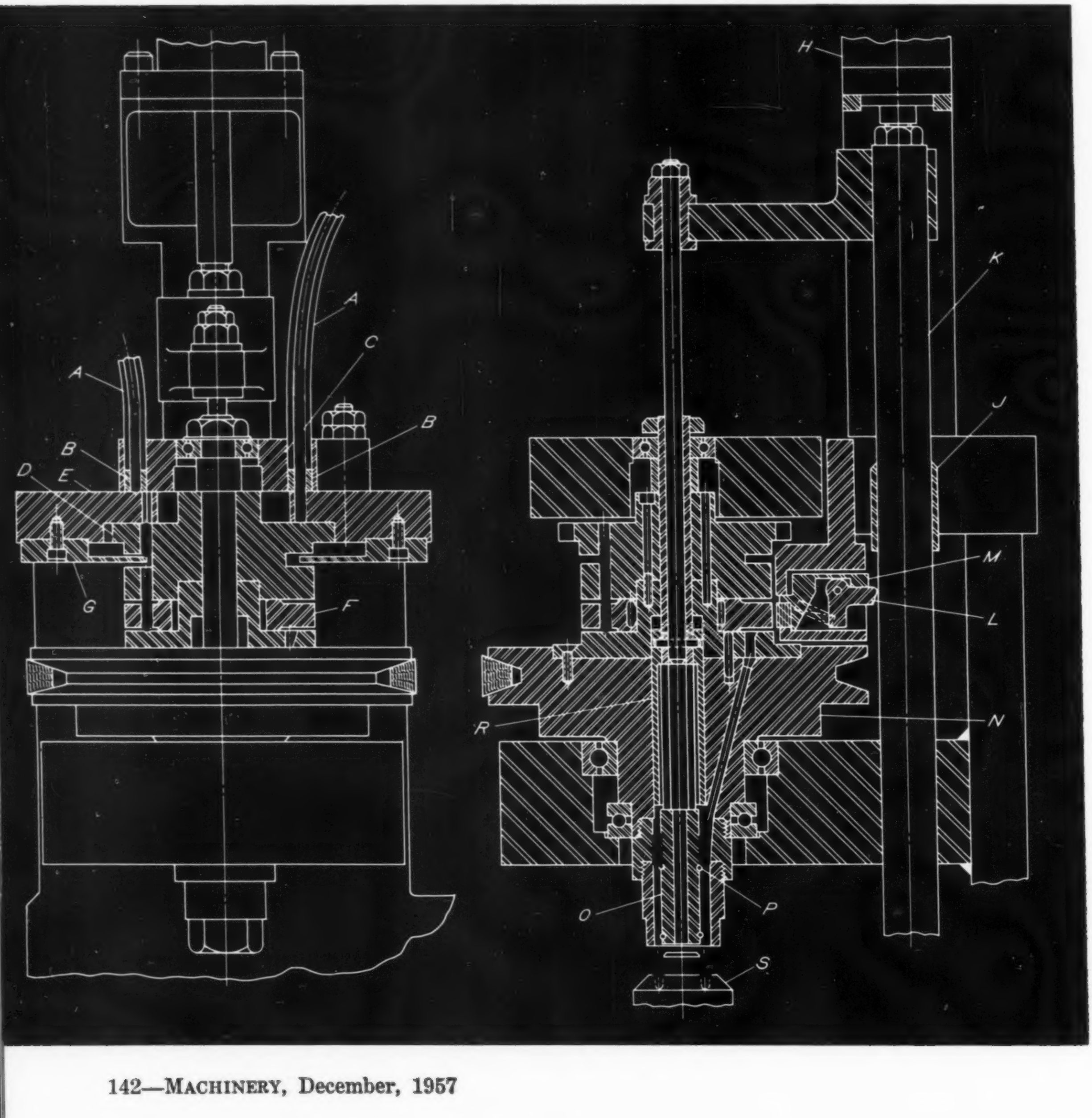
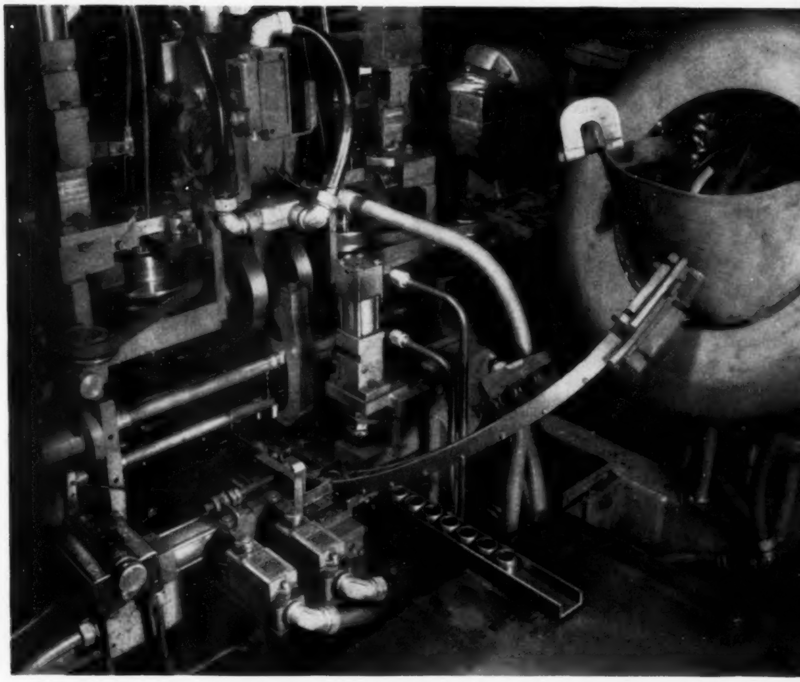


Fig. 9. Close-up of unloading end of the machine seen in the heading illustration for automatic assembly of rollers and dust caps in universal-joint needle bearings.



tact the needles in the top of the cam-ring and prevent the jaws from closing. When this occurs, one or both jaws will idle in the open position until the top row of needles in the cam-ring have been lowered.

To release a set of twenty-three needles from the escapement ring, hydraulic cylinder *H*—seen at the right in Fig. 8—is actuated. On the down stroke, a collar *J* on piston-rod *K* overrides the one-way dog *L* on brake-slide *M*. On the up stroke, this collar strikes the dog, thus advancing the brake-slide and stopping the rotation of the escapement ring momentarily.

Then the needles slide down holes drilled at an angle in the collection pulley assembly *N*, and fall into positions around a grooved arbor *O*. The rubber O-ring *P*, mounted on the arbor, keeps the needles from falling out. On the next down stroke of the cylinder, assembly sleeve *R* pushes the needles past the two O-rings and into the assembly collet S. On the up stroke, another set of needles is deposited in the grooved arbor, ready for the next cycle. Near the top of the stroke, collar *J* releases the brake-slide *M* and permits the escapement ring *F* to return to its normal position (with the holes in the escapement ring aligned with those in the multiple-lobe cam-ring *D*).

While one assembly collet is being loaded with needles, the second collection and assembly unit is over the transfer bar. A hydraulic motor rotates a dual rotary cam that contacts two followers on the assembly collet. These followers are attached to plungers within the collet, and as the cam revolves, the plungers load needles into the race.

When the next race has been transferred to the third station, the empty assembly collet is indexed by turning it 180 degrees to a position under the second needle-collection unit. Simultaneously, the loaded assembly collet that was under the other needle-collection unit is positioned over the transfer bar above the race to be filled. This turnover indexing is accomplished with a hydraulic shuttle mechanism, having a differential speed between upper and lower shuttle bars. Differential speed is obtained by the ratio between the driving and driven gears in the gear-box between the two bars. A rack attached to the upper bar causes this bar to move faster than the lower one and results in the gear rotating the assembly collet 180 degrees.

Station 5 of the automatic assembly machine is also idle to provide accessibility to the needle loading station. At the sixth station—seen at the bottom center in Fig. 9—the synthetic rubber dust caps are assembled. Caps are automatically selected from the hopper in the proper position and fed down a chute into a loading slide. This slide reciprocates to position each cap over a bearing race, and a hydraulically actuated, vertical-acting plunger presses the caps over the races. The next forward motion of the transfer bar pushes the completed universal-joint needle bearing into an ejection chute.

AC Hydroforms Sample Stampings

INCREASING DEMAND for more frequent changes in the design of automotive components has caused retooling costs to skyrocket and made delivery schedules difficult to maintain. Engineers at AC Spark Plug have solved these problems with respect to deep-drawn parts and irregular-shaped stampings by employing Hydroforming to produce prototypes and short-run production samples.

In Hydroforming, blanks are formed to the shape of the punch by controlled hydraulic pressure that is transmitted through a flexible die member. Operations are performed on a Hydroform machine, seen in the heading illustration, made by the Process Machinery Division of Cincinnati Milling Machine Co. The matching die and pressure-pad required in conventional deep-drawing work are not necessary. These units are replaced by the built-in, pressurized forming cavity sealed by the flexible rubber diaphragm, which serves as a universal die and pressure-pad for any shape part.

It has been estimated that the cost of making parts in this way, including the charge for punch and draw-ring, is only about one-fourth that required to purchase samples. Also, the cost of conventional, permanent production tools to produce the same parts would be up to twenty times or more that of making Hydroforming tools. The latter comparison does not, of course, represent actual savings, since production tools are sometimes built for many parts that were originally produced on the Hydroform machine. However, in all cases, the permanent tools could not have

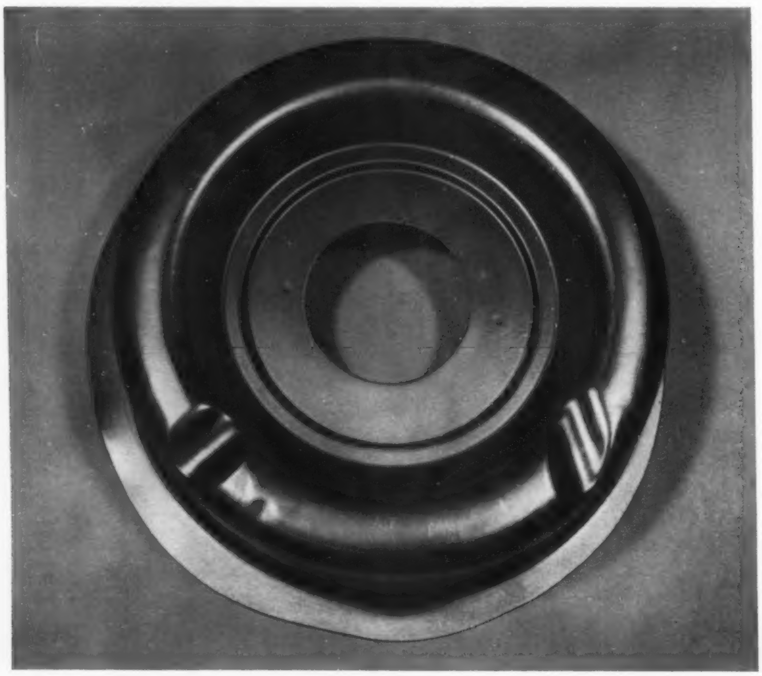


Fig. 1. Punch and draw-ring for Hydroforming this Cadillac air cleaner shell cost only $378. Permanent production dies for the same part amounted to $18,000.

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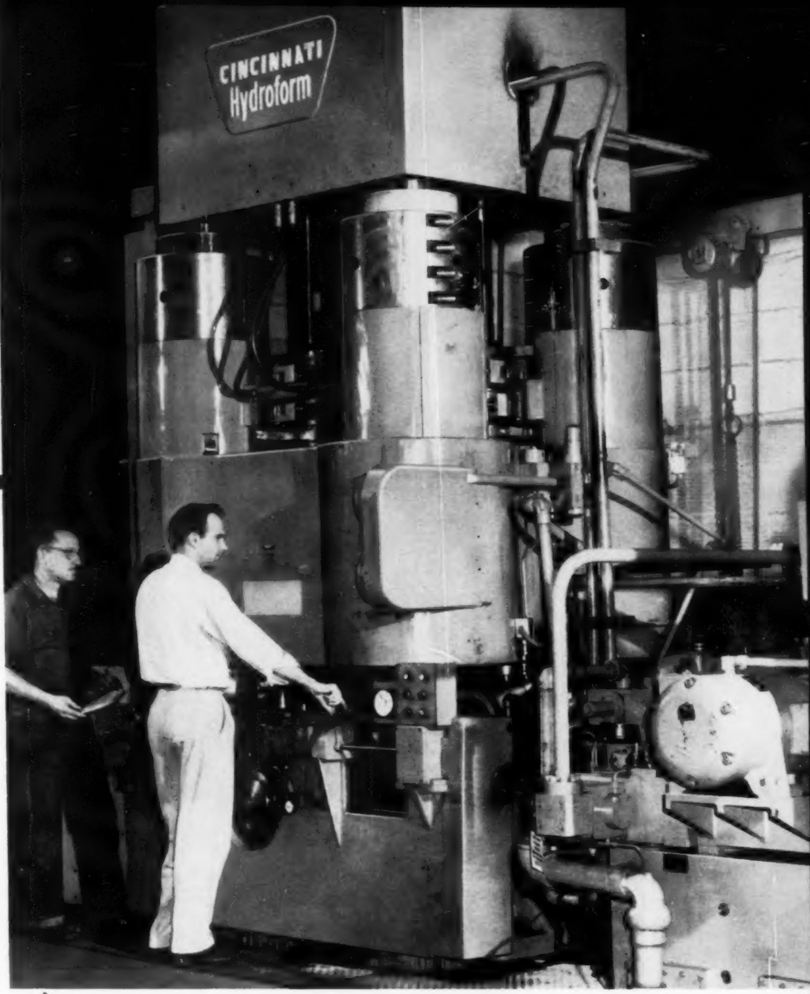


Controlled - pressure forming on a Cincinnati Hydroform machine does away with the need for matching die and pressure-pad. As a result, proposed design parts can be made rapidly and at low cost.

been finished in the required time to make production samples.

One example of the many parts produced at AC by the controlled-pressure, hydraulic forming method is the shroud, Fig. 1, for a Cadillac air cleaner. Blanks 24 inches in diameter and having a 3-inch diameter center hole were used. A total of twenty-seven parts were produced from 0.018-, 0.025-, and 0.0295-inch thick blanks of cold-rolled steel, using a low-melting alloy (Cerromatrix) forming punch. This punch and the draw-ring cost only $378, while the three permanent production dies subsequently required amounted to $18,000.

Hydroforming is a Versatile Process

Versatility is a major advantage of this process. It is not limited to round or symmetrical parts, and a wide variety of types and thicknesses of material—up to 3/8-inch thick mild steel and 5/8-inch thick aluminum—can be handled. At AC, parts have been made from 0.018-, 0.025-, 0.031-, and 0.062-inch thick blanks with the same tools. When more than one draw is required, a stack of two or more parts can be preformed at one time. Also, thin parts can be pierced and trimmed during forming, and holes can be extruded by means of piloted plugs which force the material into a recess in the punch.

Fewer operations are generally required, with initial reductions of 50 to 70 per cent normal. Intermediate annealing operations, sometimes required with conventional methods of severe forming and deep-drawing, are eliminated. In many instances, thinner blanks of smaller diameter can be used, thus affording material savings. Since no die marks are produced, improved quality parts can be obtained with little or no polishing. In fact, parts can be Hydroformed after painting, plating, or polishing.

Uniform working of the material during controlled-pressure hydraulic forming retains the mechanical and physical properties of the material. Since the material is displaced rather than stretched, there is a minimum of localized thinning. Also, spring-back is minimized, thus permitting improved dimensional accuracy.

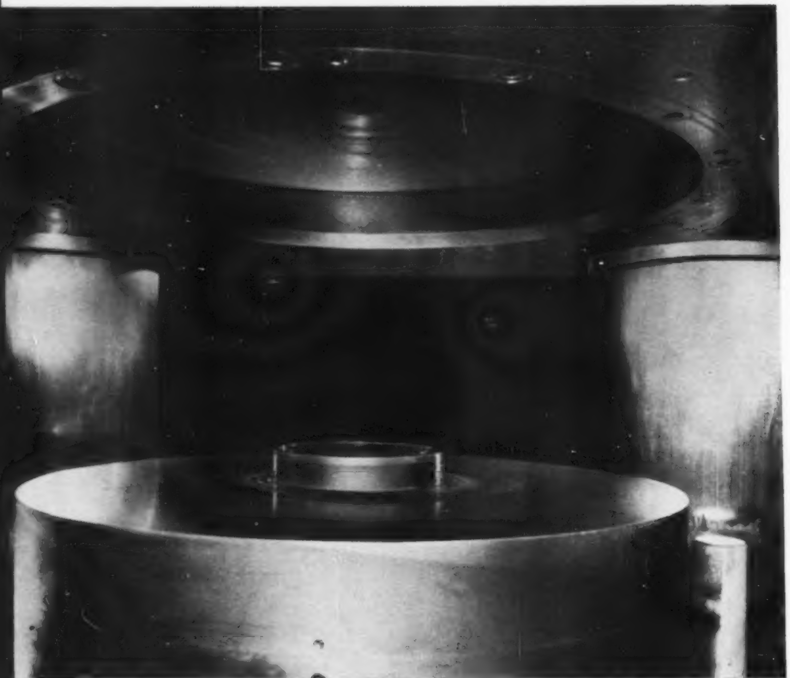


Fig. 2. Press dome containing flexible die member is shown in raised position with the punch lowered to strip the finished part. Locking cams keep the ram up.

Hydroforming affords a rapid method of converting design ideas into prototypes. Many modifications of the original product design can be made with a minimum of cost and tooling changes, and different types and thicknesses of materials can be tested. The quality and appearance of the part are much better than if made by hand hammering or spinning. Finished parts can be used for permanent tool layouts and press tryouts. Many of the tools are interchangeable or can easily be modified for different parts, resulting in lower tool and development costs as additional parts are produced by this method.

Details of Operating Cycle

In operation, the blank is placed on the top surface of the draw-ring, and the press dome containing the flexible die member is lowered. When in forming position, the dome is locked, and an initial pressure is applied to force the underside of the outer edge of the part against the draw-ring, thus preventing wrinkling during forming. After the pressure has reached a pre-set amount, the punch is moved upward, causing the flexible diaphragm to form the blank to the configuration of the punch. The displacement thus created in the hydraulic cavity causes the pressure to increase and exert uniform forces on the part from all directions. This is called the natural cycle.

Forming pressure can also be controlled automatically, and is normally increased during the drawing operation to decrease the corner radius formed on the part by the die. This "edging" method of controlling the radius on the flange is controlled by applying pressure while moving the punch down slightly. The amount of punch movement depends on the metal thickness, amount of radius required, and the radius on the draw-ring. The automatic control of pressure exerted during forming is obtained by a flat cam mechanically connected to the lower hydraulic ram. Adjustable set-screws extending from the cam contact a pressure valve, thus raising or lowering the pressure, depending on the amount that the screws protrude. A drum cam having T-slots for holding adjustable dog type stops is also provided. One stop controls the height to which the punch is raised, a second edging stop provides for sharpening the drawing radius, and the third controls automatic stripping of the part from the punch after forming.

When forming has been completed, the pressure is released and the dome raised. Then the punch is lowered, stripping it from the finished part, as seen in Fig. 2. For safety, the upper ram is held in the open position during loading and unloading by four locking cams. These cams also fit into grooves in the press columns to lock the ram in the closed position during forming.

The Hydroform machine used at AC is the largest of its type made. Blanks up to 32 inches in diameter can be drawn to a maximum depth of 12 inches with punches varying in size up to 26

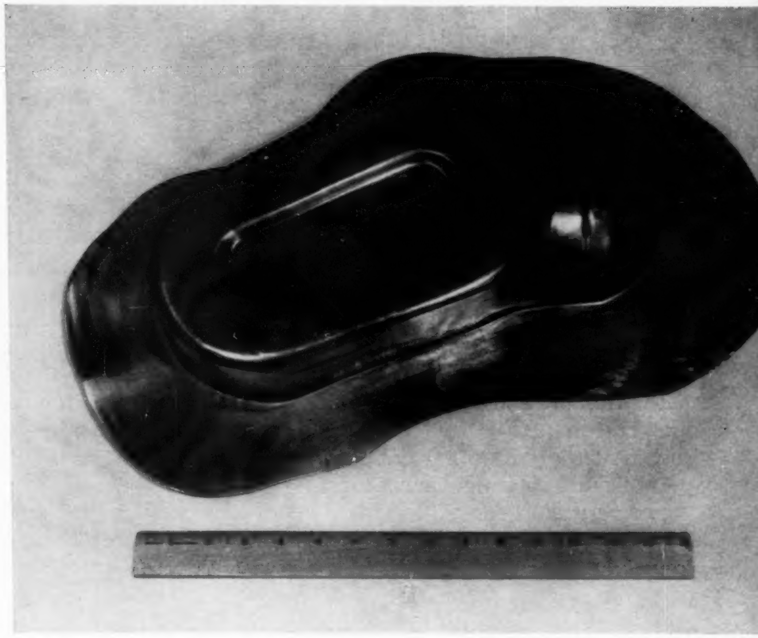


Fig. 3. Lower shroud for a Corvette air cleaner Hydroformed from a 0.031-inch thick cold-rolled steel blank. Ironing of the shroud is done with auxiliary rings at 200 psi.

inches in diameter. Maximum dome-cavity pressure is 10,000 psi, and the machine can be operated at 90 cycles per hour.

Examples of Parts Produced

In forming the shroud seen in Fig. 1, an initial holding pressure of 500 psi was exerted to clamp the blank. Then the pressure was increased from 500 to 1000 psi by means of the cam-controlled cycle. When the punch had been raised 3 inches into the flexible diaphragm, the pressure was allowed to increase to 8300 psi by means of the natural cycle.

A more complex part made by Hydroforming is the lower shroud for a Corvette air cleaner, Fig. 3. The shrouds were made from 0.031-inch thick cold-rolled steel with the blank size determined by adding 3 inches to the basic dimensions of the part. To assist in preventing the formation of wrinkles during forming this complex-shaped part, a ring and two strips (made from 1/16-inch thick sheet metal) were placed between the flat blank and the flexible diaphragm. The ring was placed near the back edge of the blank, and the two strips at the toe of the part.

An initial holding pressure of 200 psi was employed. Then, using the natural cycle, the pressure was increased to 1800 psi—corresponding to a punch travel of 1 9/16 inches. At this point, the back reinforcing ring was removed, and the pressure increased to 2200 psi without moving the punch. The natural cycle was then resumed during a punch travel of 3/8 inch, thus increasing the pressure to 3100 psi. After moving the two strips at the toe further out on the blank, the punch was raised another 1/2 inch to increase the pressure to 4000 psi naturally. Then the strips were removed, the pressure increased automatically to 4400 psi, and the natural cycle continued until drawing was completed. Finally, the shrouds were ironed with auxiliary rings at a pressure of 200 psi. For this particular part, the cost of the Hydroforming tools was only one-tenth that of permanent production dies.

Another example of successful Hydroforming is the chamber cover for a Chevrolet air cleaner illustrated in Fig. 4. A total of sixty-five parts, 13 inches in diameter by 2 1/2 inches deep, were made from 0.031-inch thick tinned SAE 1008 steel. Blanks were 20 inches square with a 2-inch diameter center hole, and the upper half trimmed to a semicircular shape. The forming punch used was made from a low melting-point alloy, Cerromatrix. Pressures employed varied from 400 (holding) to 8000 psi. A rubber insert was placed on the punch at the point where the deepest depression was to be formed to prevent excessive metal flow into the punch cavity. After drawing to about a 1-inch depth, the rubber insert was removed and the draw completed, using the natural cycle.

Tooling for Hydroforming

Punches can be made from cold-rolled steel, cast-iron, tool steel, Kirksite, Cerromatrix, plastic, brass, aluminum, or hard wood. The choice of

punch material depends on the material to be formed, the quantity of parts required, the shape of the part, and the severity of draw. Punches are secured either by a screw thread or a stud attached to an extension of the forming piston located under the press bed.

Draw-rings are generally made of cast iron or steel, hardened if required. They are placed over the punches and rest on the draw-ring support (bolster plate). Clearance between the punch and draw-ring is not critical and may be 50 per cent or less of the thickness of the material being formed. Undercut draw-rings, such as the one illustrated at the top in Fig. 5, are used to eliminate overhang and are sometimes helpful in forming odd-shaped parts. Contoured draw-rings, shown at the bottom, are also useful in forming parts having an irregular contour.

For very short runs, a top plate may be placed on an existing draw-ring, as shown in Fig. 6. The overhang of the top ring should not exceed its own thickness, and the plate must be smaller in diameter than the outside diameter of the draw-ring to clear the edge of the dome. Since there is no way of connecting the top plate to the draw-ring without ruining the ring, rubber strips are placed on top of the blank to break the vacuum caused by dome action during drawing. Various methods of locating the blank include counterboring the draw-ring to the depth of the blank, or providing pins, brackets, fixtures, or plugs on the draw-ring. Pins, brackets, or fixtures should not be higher than the thickness of the blank. Also, plugs can only be employed for locating purposes when the necessary mating holes are required in the blanks.

Avoiding Overhang of Blank

Excessive overhang of the blank between the draw-ring and punch, as illustrated at *A* in Fig. 7, should be avoided since it may result in rupture of the metal or wrinkling of the part. This can be avoided by preforming with a smaller-bore draw-ring *B* and finishing in a second operation as seen at *C*. An alternate method would be to use a dome-shaped punch with the smaller-bore draw-ring for preforming.

Another method of avoiding excessive overhang is to use double-acting punches, Fig. 8. In the design at the left, the inner punch draws the upper portion of the part, and the outer punch forms the remainder. At point *A* the punch can be used to pinch-trim the part. With the design at the right, the ram raises the inner punch to form the upper portion of the part, while the support pins raise the outer punch to complete the part. The travel of the support pins must equal the depth of the second draw.

A larger radius is generally required on the punch and draw-ring when the overhang is great. If the radius of the draw-ring is too great to obtain the desired flange radius on a part, secondary tooling may be needed. One method of increasing the metal flow during Hydroforming is to cut off the corners of the blank, thus reducing the area

Fig. 4. Forming punch made from a low melting-point alloy and a final pressure of 8000 psi were used to produce this air cleaner cover.

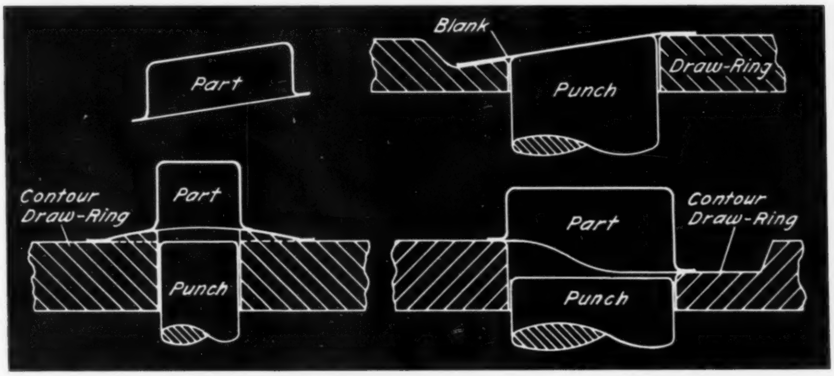


Fig. 5. Undercut (top) or contour-shaped draw-rings (bottom) are sometimes used to eliminate overhang of blank, or to aid in forming odd-shaped parts.

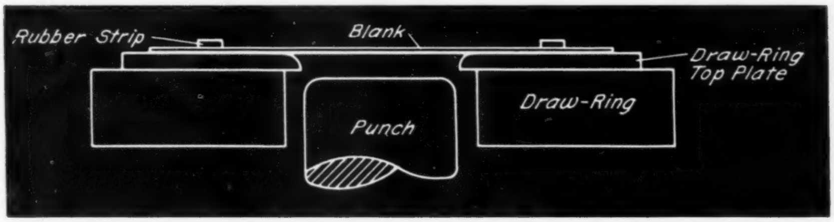


Fig. 6. Plate can be placed on top of existing draw-ring for Hydroforming relatively few parts. Rubber strips are placed on top of blank.

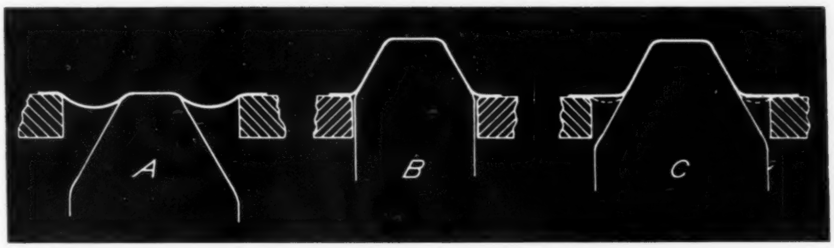


Fig. 7. To prevent excessive overhang of the blank (A), the part should be preformed as seen at (B) before finishing in a second drawing operation (C).

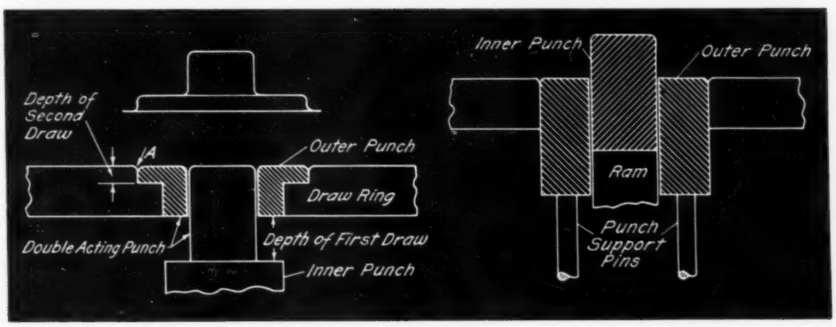


Fig. 8. Two examples of double-acting punches used to prevent rupture of the metal or wrinkling of the part due to overhang of blank.

of the blank and decreasing the holding force required. Draw-beads can be provided to decrease the flow of metal in desired areas. Also, the amount of drawing compound is critical. Too much will cause the metal to flow fast and cause wrinkles; too little will cause the metal to rupture due to excessive drawing action. At AC, a lanolin-base Cimcool coolant is used as a lubricant. The lubricant is in paste form and is brushed on the blank.

The flexible diaphragm used for Hydroforming is cup-shaped and made from 2 1/2-inch thick rubber. A replaceable wear sheet is cemented to the lower surface of the diaphragm for contacting the blank.

Life of a single diaphragm can range up to 15,000 parts or more. The diaphragm is retained in the dome by seal and snap rings. A roller conveyor is provided at the rear of the press for moving the punch, draw-ring, and draw-ring supports into position. Tools can be changed in one hour or less.

Experienced Hands Shape a

Thousands of man-hours of careful planning have been devoted to initiating production of the latest addition to the field of American motor cars—the Edsel automobile. This new line of cars is being turned out at several of the Ford Motor Co.'s assembly plants scattered across the country.

RAYMOND H. SPIOTTA
Associate Editor

EDSEL, the newest addition to the automobile family of the Ford Motor Co., has made its debut in the 1958 model year. It is being offered in four passenger car series and five station wagon selections–a grand total of eighteen models. This extensive selection is intended to engage in sales combat with competitive nameplates representing a wide range of price tags.

Designing, manufacturing, and assembling the all-new line of cars was a two-hundred and fifty million dollar undertaking. In this first year of its presentation, Edsel production is being absorbed by existing Ford and Mercury facilities. Nevertheless, suitable assembly lines had to be set aside and completely retooled.

At the beginning of one line that has been set up to handle Corsair and Citation series only, is a newly installed floor-pan welding fixture, Fig. 1. The floor pan is built up of three main parts: a lead section, a center section, and a rear extension. All three stampings are positioned on this 5-ton Artco fixture. Both main seams are locked in contact with back-up bars by pneumatically operated cross-clamps. Rear fender areas are supported independently on cantilever brackets and are rigidly held by Garland portable air clamps suspended overhead. The clamps are shown being applied at the right.

Hand-held Progressive spot-welding guns are used to complete the joints. As can be seen at the left, a protrusion at the top of the gun rides freely in a guide way in the under side of the cross-member. The same technique is used on the second main joint connecting the center section with the rear extension.

One additional piece is added to the rear extension. Using a Progressive C-clamp type spot-welding head (not shown) suspended on a steel cable, a stamped housing for the fuel filler neck is joined to the upper surface of the floor pan.

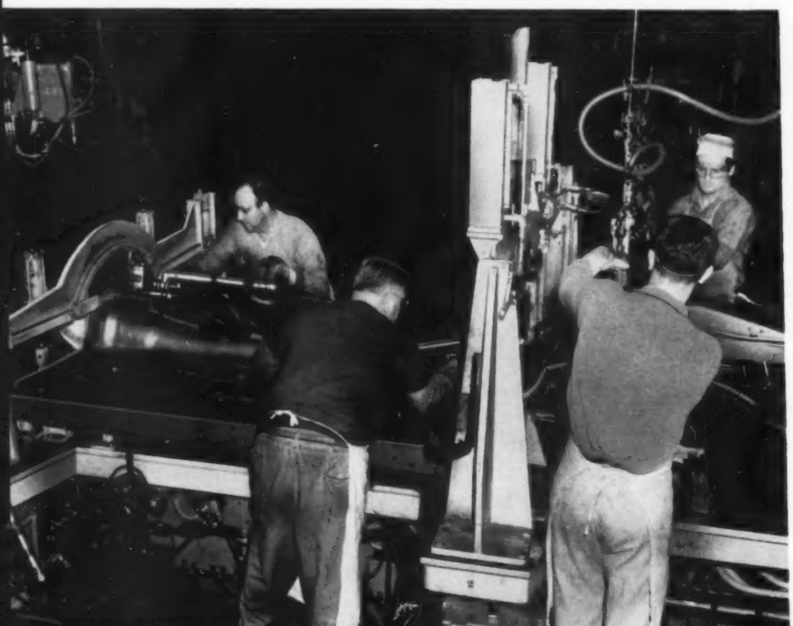


Fig. 1. Five-ton welding fixture is used to position and join the three main floor-pan stampings. The stationary halves of the two cross-clamps (beneath the pan) serve as the lower electrodes.

New Car

The spot-welding equipment used for fabricating the floor pan is powered by several Goodrich transformers that are also suspended overhead.

A few feet from this fixture the body shell begins to take shape. Both a left- and a right-hand side panel sub-assembly, a windshield and cowl assembly, two back-panel strips, and a canopy are loaded into one of two 13-ton body bucks. The members are positioned and the buck is locked up. Less than three minutes later an overhead electric hoist lifts the spot-welded body shell from the buck.

The shell is lowered over a waiting floor pan, Fig. 2. After being hooked together they are placed in a second buck where the pan is welded to the body.

An unusually stringent check is made on the "white" bodies at regular intervals to be certain that all contour and fit specifications are closely adhered to. Bodies are selected at random from an automatic transfer table delivering them from the arc-welding line to the gas-welding and tin-soldering line. They are then placed on the locating cradle of the master checking fixture shown in Fig. 3. The cradle rests on an accurately machined cast-iron baseplate measuring 110 by 240 inches. This 25-ton fixture was constructed to company specifications by the Hydro Mfg. Co.

Two gates are swung into place, one on either side of the body, then accurately located and locked to the fixture cradle. On each of these gates are numerous gage points, each supported on a toggle arm, that are advanced toward the body. The gage points are color coded with respect to the model car they are intended to check. As can be seen in the illustration, the right-hand gate is in place and the appropriate gaging members advanced. The left-hand gate is being swung into position.

On the four-door model, 108 check points are noted—fifty-four on each side. Of these, thirty are considered critical. The two-door model is checked at a total of ninety-six points—twenty-eight of these being critical. Bodies for the convertible models are checked at forty points, of which eighteen are considered critical.

When advanced, the gage points should be close to, but not touching, the body. Normally, there should be a clearance of 0.120 inch. When the clearance at any critical point varies 0.060 inch, an investigation is launched to determine the reason for the out-of-tolerance condition and to correct it. The trouble could lie either in the stamping plant or on the assembly line. Separate gaging fixtures are used to check the openings for the windshield, instrument panel, doors, and rear-deck lid.

After completion of this detailed inspection, the body is returned to the conveyor. Further down the line, welded canopy joints are filled with solder and ground flush with the body contour. The doors and rear-deck lid are then hung and the outside metal inspected for dents, scratches, or other surface imperfections that may have been received during the previous assembly stages. All such areas are marked.

Fig. 2. Partially completed body shell being lowered over a waiting floor-pan weldment. Both members will then be placed in a body buck to be joined by welding.

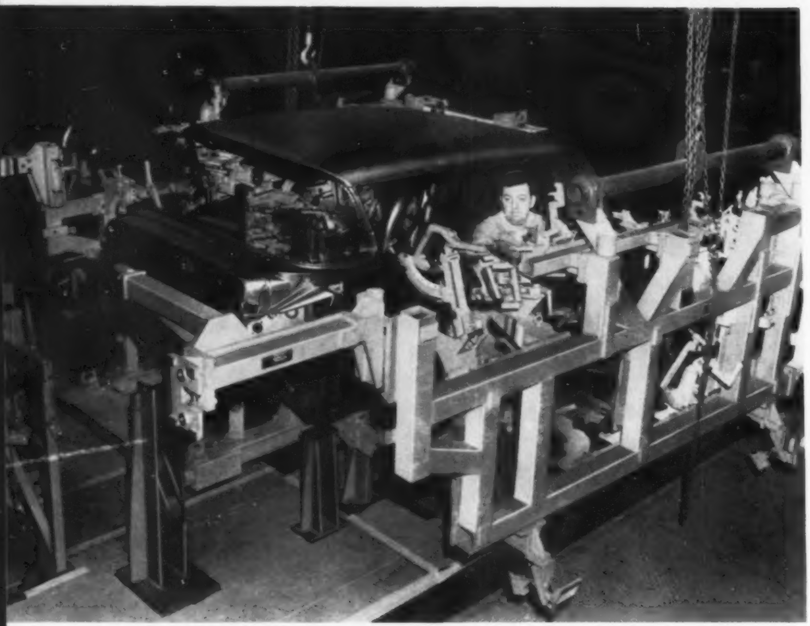


Fig. 3. Master checking fixture for "white" bodies. Two-door, four-door, and convertible bodies are selected at random and checked for contour and alignment. Tolerances are in thousandths of an inch.

Fig. 4. After the doors and rear-deck lid have been hung, the exterior sheet metal is inspected for scratches and dents. These are blended in with pneumatic right-angle disc grinders.

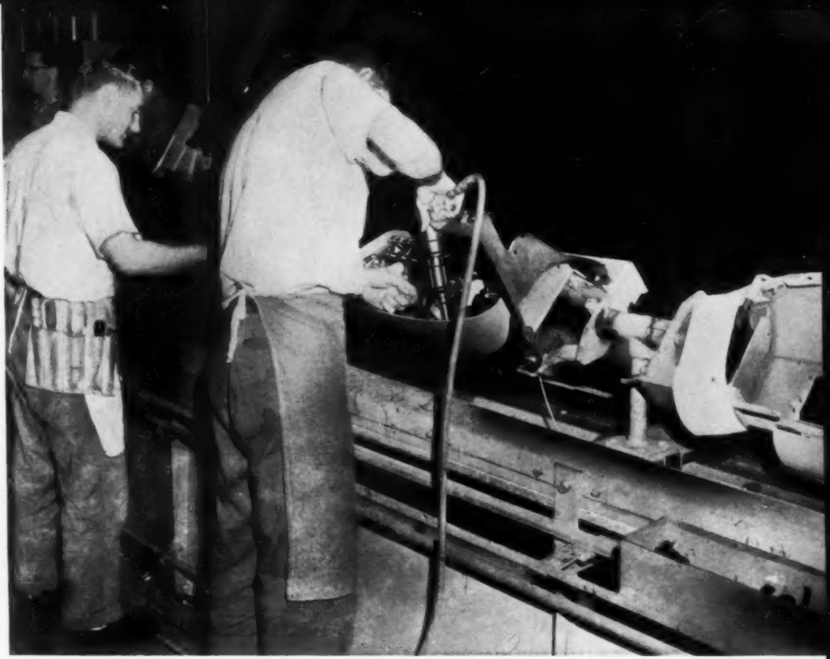


Fig. 5. Instrument panels are assembled while supported on conveyor-mounted fixtures. An instrument cluster is shown being secured. If required, a foam-plastic crash pad is installed at this point.

Pneumatic right-angle disc grinders are used to blend the surface imperfections with the surrounding metal, as can be seen in Fig. 4. When working on exterior metal surfaces, 80-grit abrasive discs are used. For rougher operations the abrasive disc may be as coarse as 36 grit.

A great many portable tools are used in the assembly of an automobile. On the line shown in the accompanying illustrations, all are of the pneumatic type and are fed from a single compressor housed outside the main building. Large service pipes run alongside the conveyors. At each point that these pipes are tapped, a line filter and oiler are plumbed into the circuit to provide individual service to the air tools. One of these units can be seen in the lower right-hand corner of Fig. 4.

A rust-inhibiting paint base is applied to the bodies in a five-stage phosphatizing system. This is followed by two coats of primer. Each body is then wet-sanded by hand and sent through a newly installed two-tone paint system. The self-contained unit, consisting of spray booth and baking oven, measures 393 feet in length. Areas to be given a second color are again wet-sanded manually before re-entering the spray booth.

Instrument panel weldments are given a prime coat and a final color coat before being placed in conveyor-mounted assembly fixtures. The fixtures are of the trunnion type. While the rear side of the panel is exposed, the hand-brake release cable, hood release, clock, cigar-lighter receptacle, and heater-control unit are installed. With the fixture reversed and the front of the

Fig. 6. Assembled instrument panels, traveling on an overhead conveyor, meet the partially completed bodies. The panels are placed on the car floor, to be mounted on the next trim line.

Fig. 7. First step in the fender line. The stampings pass through a metal finishing area where scratches are removed and the surface is prepared for rustproofing, priming, and painting.

panel exposed, the instrument cluster is inserted and secured with a pneumatic nut-runner, Fig. 5. Immediately following this, a foam-plastic crash pad is coated with adhesive and pressed in place.

Completely assembled instrument panels travel suspended from an overhead conveyor for delivery to the end of the No. 1 final trim line. Here the panels are removed from the conveyor and placed within the bodies, Fig. 6, to be installed on the No. 2 trim line. Sequence of panel colors along the overhead conveyor and sequence of body colors along the trim line are identical as they approach this point. Information regarding each automobile to be assembled—such as colors and equipment—is relayed simultaneously to every concerned section of the assembly area. Therefore, all sub-assemblies for each particular car on the line are handled in the same order.

At the start of the fender line the stampings pass through an enclosed metal finishing area, Fig. 7. Each fender is gone over with right-angle pneumatic disc grinders to remove all surface marks and to prepare the metal for subsequent finishing. Each fender is carefully inspected as it leaves the enclosure. If scratches are found, the areas are marked and the fenders reworked.

The fenders are phosphate-coated in a new 88-foot long Mahon phosphatizing system. Then they are given two prime coats: one coat of red epoxy primer followed by one coat of gray epoxy

Fig. 8. Assembly of front fender and grille units is carried out on a closed-loop conveyor. Two fenders begin their journey at the left, while a completed assembly arrives at the right.

Fig. 9. Opposite end of the 160-foot closed-loop conveyor shown in Fig. 8. Recessed-head screws are being driven home during installation of dual-headlight units.

primer. As was the case on the body line, each fender is manually wet-sanded before entering the final color spray booth.

Front fender and grille assemblies are built up on the merry-go-round conveyor system shown in Fig. 8. Two painted fenders are located and locked on a traveling assembly fixture at the first station (left-hand side in the illustration). As the fixture progresses down one side and back along the opposite side of the 160-foot long loop, the front end takes shape. A completed unit can be seen at the right-hand side in the illustration. Dual-headlight units are shown being installed with the aid of a pneumatic screwdriver at the opposite end of the loop in Fig. 9.

Because only the Corsair and Citation series are being assembled on this line, engine-handling problems are simplified. One engine—the E-475 (345 hp)—is used in both cars, therefore a single engine dress-up line suffices. Mounting of an engine and automatic transmission to the chassis is one of the first steps on the final assembly line.

The steps remaining on this final line, after body decking, include installation of the hood, front bumpers, and wheels. In Fig. 10 can be seen an Ingersoll-Rand multiple nut-runner being used to tighten all five wheel lugs simultaneously. Each of the five wheels is balanced. This is done immediately after the tires have been mounted and inflated. They are placed on a static balancing machine that quickly indicates the size balance weight to be used and its exact location.

Fig. 10. Approaching the end of the line. Among the last few items to be installed are the wheels. A multiple nut-runner tightens all five lugs simultaneously. Each wheel is statically balanced and corrective weights added.

OLDSMOBILE'S Rocket Engine Transfer

Output of Oldsmobile V-8 engines has been boosted by means of a new transfer machining line having additional heads, more automatic materials-handling devices, built-in gaging units, and stock banking stations. Slower operations have been made more efficient by dividing the work between several heads and machining alternate blocks at successive stations.

IN PROVIDING additional production facilities to meet the increasing demand for Rocket engines, Oldsmobile engineers have incorporated the latest advances in manufacturing techniques into a new automated line of transfer machines. This line has a capacity of over seventy-five engines per hour.

An increase in productive capacity has been attained by providing integral inspection devices, additional machining heads, and a greater number of automatic materials-handling units. Also, banking stations for the temporary storage of partially completed cylinder blocks are furnished at various locations along the line. This permits shutting down parts of the line for maintenance and tool changes without interrupting production. Operations requiring a longer-than-average cycle have been divided among several heads, and in some cases, identical operations are performed on alternate blocks at successive stations.

Cylinder-block castings are qualified by means of a fixture gage, and a Magnaflux Sonigage is used to check the wall thickness of the cylinder bores ultrasonically. Acceptable castings are unloaded from shipping pallets and conveyed to the loading station of an Ingersoll thirty-six station transfer machine. Actually, this unit is made up of ten individual machines interconnected to form two main sections. A total of ten idle stations have been provided to accommodate tooling that may be needed for possible design changes.

Blocks are loaded into this first transfer machine with their pan-rail surfaces facing down. After milling four locating pads on each block and inspecting the pads with a fixture, the blocks are turned 90 degrees by means of a rotating fixture so that the pan rails are in a vertical position. Then the half-round crank bearings and the No. 5 cam bearing are rough-bored, and the pan rail and bearing cap seats are milled.

Bottoms and sides of the bearing-cap seats are finished in two passes by shaving with solid carbide blades. After rough- and finish-milling the top surfaces, the blocks are turned 90 degrees more so that the pan rails face up. Then two locating holes are drilled, chamfered, and reamed; and the sides and anchor notches of the crank bearings, as well as the oil dip-stick pad, are milled. Manually controlled fixtures are used to inspect the pan-rail surfaces for flatness and the bearing-cap notches for depth.

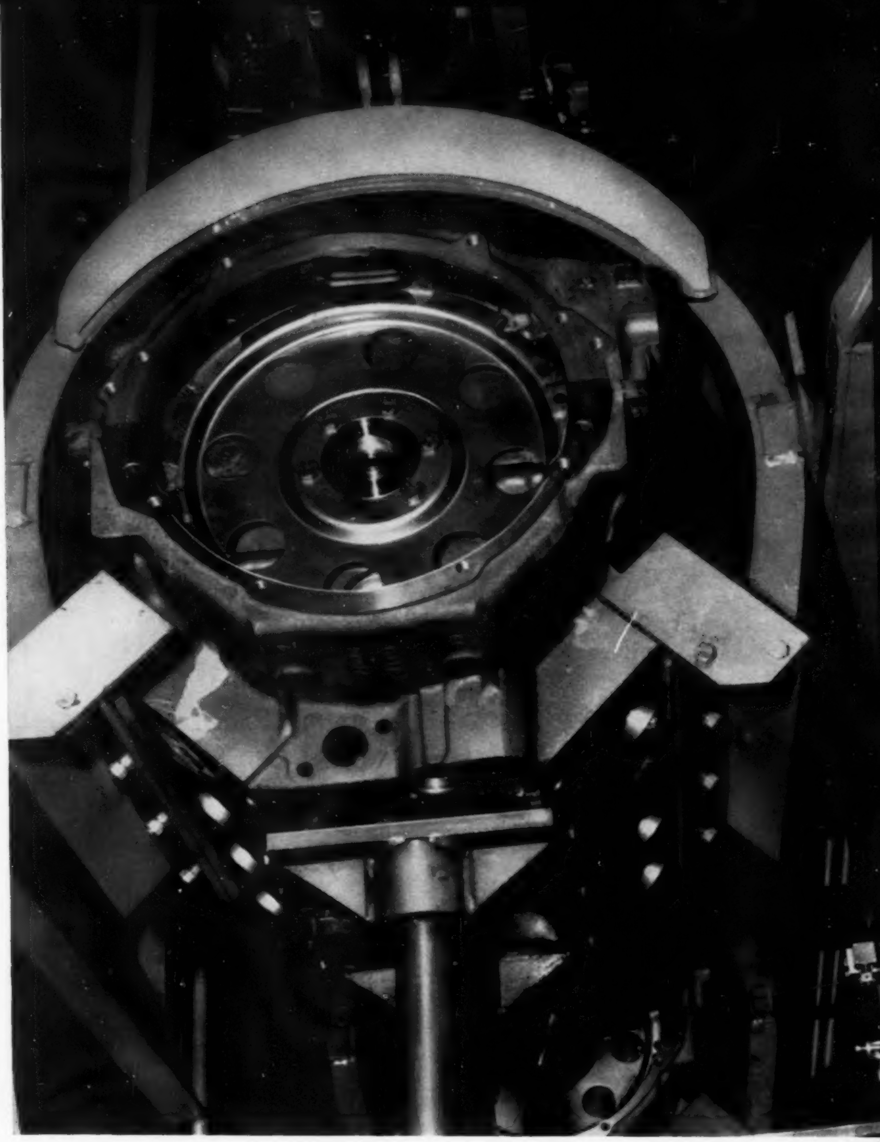
Wilson equipment, Fig. 1, is provided at the unloading end of this first machine to turn the blocks over endwise, transfer them lengthwise, and elevate the blocks to a transfer unit over an aisle having a 10-foot clearance. A banking unit for storing partially machined castings is also provided above the aisle. This and other automatic units are hydraulically operated.

When the blocks have been lowered to conveyor height (40 inches) on the opposite side of the aisle, they are automatically loaded into a second Ingersoll transfer machine. Here the bank faces are rough- and semifinish-milled, the cylinders are rough-bored and chamfered, and the oil-filter pad is milled. Ingersoll "Shear-Clear" and "Cover Lock" cutters having tungsten-carbide-tipped blades are used for milling and boring, respectively.

Next both ends of the engine blocks are rough-milled, the front end is finished-milled, and the rear end is semifinish-milled on another Ingersoll transfer machine. Various holes in both ends of the blocks—including the water pump, dowel, pipe tap, and camshaft holes—are drilled, chamfered, reamed, or tapped, and the cam bearings are rough-bored, on a Greenlee thirty-two-station transfer machine. This machine is equipped with an automatic banking unit having a capacity for storing seventeen blocks.

Line

CHARLES H. WICK
Managing Editor

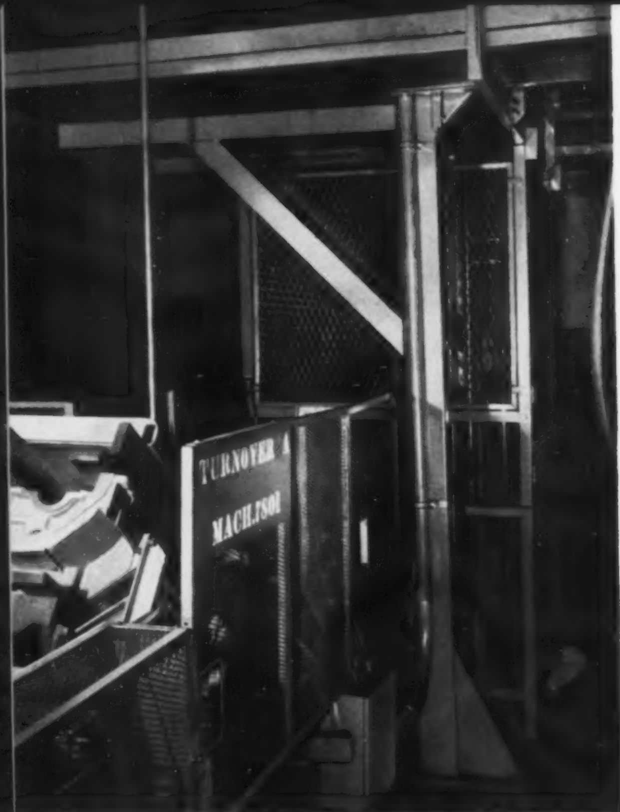


Wilson equipment is used to transfer the blocks from the unloading end of the Greenlee to the loading station on a Natco eighteen-station, indexing type drilling machine, Fig. 2. A storage unit is also provided at this location. On the Natco machine holes for dowels, oil-pan clamp bolts, crank bearing-cap bolts, oil drain, flywheel-housing clamp bolts, oil-pump shaft clearance, oil-filter bracket clamp, and oil dip stick are drilled in the bottom and sides of each block.

Another Natco straight-line type indexing machine, this one containing thirteen stations, is employed to drill, ream, chamfer, or tap additional holes in the top and side surfaces of the blocks. All the drilled holes are inspected by probes at one station, and the blocks are rejected, if unacceptable, at the next station. Also, the work-pieces are rotated at two different stations to dump chips. Both machines have hydraulic clamping and indexing units, and are furnished with Cross control boards for pre-setting and storing the cutting tools. Toolometers on these boards indicate when the tools should be changed.

Holes in the top and bank faces of the block are drilled and reamed, and the distributor hole is core-drilled and semifinish-reamed on a Baush thirty-five-station transfer machine, Fig. 3. The blocks are automatically loaded into the machine by means of a Wilson overhead transfer unit. A dummy bushing plate is provided at the second station to check the cavity in each block for clearance. A block storage unit, seen at the left, is also provided at the loading end. Blocks are loaded with their bottom faces down and front ends leading.

Eight push-rod clearance holes, 1 inch in diameter, are drilled in both bank surfaces by left- and right-hand head tooling at Stations 4 and 6. The vertical heads at the sixteenth and eighteenth stations each carry nineteen spindles for drilling



one 0.316-inch diameter distributor hold-down hole; chamfering two 0.261-inch diameter cover holes; and drilling sixteen 5/16-inch diameter oil-reservoir holes in the valve-lifter holes. Chips are dumped from the blocks by means of 180-degree roll-over fixtures at Stations 20 and 26. Vertical heads at the thirty-second and thirty-third stations are equipped with tungsten-carbide-tipped tools to rough-core-drill the distributor-shaft hole to a diameter of 1.3797 inches and semifinish-ream the hole to a diameter of 1.4377 inches.

At the unloading end of this first Baush machine, the cylinder blocks are again elevated, transferred overhead above an aisle, lowered, and automatically loaded into the next machine by means of Wilson equipment. An over-the-aisle banking unit and a 180-degree turntable are also provided. The balance of the holes in the top and bank faces of the blocks are drilled, reamed, chamfered, or tapped in a second Baush transfer machine, this one containing thirty-six stations.

Blocks are loaded into this machine bottom face down and front end leading. At Station 6, left- and right-hand heads and a vertical head are equipped with probes for checking the thirty-six cylinder-head stud holes, the sixteen valve-lifter holes, and three other holes. Each probe has a hole for an air blast that is used to clear chips. All thirty-six of the cylinder-head stud holes are tapped (7/16-14 threads) by eighteen-spindle right- and left-hand heads at Station 26. The sixteen valve-lifter holes are checked simultaneously at both bottom and top for diameter (0.9225 inch) and angle (45 degrees) with a Sheffield Lectrolair automatic gaging assembly built into the transfer machine at the thirty-fourth station, Fig. 4. Blocks not passing this inspection are automatically ejected.

Clamping and indexing operations on both Baush machines are done hydraulically. All of the self-contained heads are equipped with mechanical lead-screw feeding units which provide a constant feed rate without the need for adjustments. The spindles automatically stop rotating at the end of each cycle to minimize wear.

After the blocks have been washed, the bearing caps and bearing-cap bolts are assembled by hand and tightened to the required torque mechanically with Keller nutsetters. Then the cylinder block and lower housing sub-assemblies are loaded, pan rails up, into another Ingersoll trans-

Fig. 1. (Above) At the end of the first transfer machine the cylinder-block castings are turned over and elevated to a transfer unit that is located over an aisle.

Fig. 2. (Left) Eighteen-station transfer machine for drilling various holes in the bottom and sides of the cylinder blocks at the rate of over seventy-five per hour.

fer machine. This machine is divided into three sections, with Wilson automatic transfer and storage units between successive sections. Elevators are also provided between the first and second sections so that the blocks can be transferred over an aisle.

In the first section of this transfer machine, the cam holes are semifinish- and finish-bored; the crank holes are semifinish-bored; the oil-seal and oil-slinger grooves are rough- and finish-turned; and the thrust-bearing surface is finish-faced and chamfered. The finish-bored, cast-iron cam holes are automatically inspected for diameter, and blocks not within the required tolerances are rejected at Station 9. In the second section of the machine, five babbitt metal, cam-bearing liners are pressed into each block. Duplicate operations are performed on alternate blocks at the twelfth and thirteenth stations—finish-boring the five cast-iron crank holes to a diameter between 2.9370 and 2.9380 inches, the five babbitt cam liners to a diameter between 1.9995 and 2.0010 inches, the distributor-shaft hole (1.515 inches in diameter), and two dowel holes (0.619 inch in diameter).

A large combination air-electric gaging unit, Fig. 5, has been built into the transfer machine at Station 14 for automatically inspecting, classifying, and marking the blocks according to the sizes of the five finish-bored crank holes and the babbitt cam liners. The gaging elements and classifying equipment were supplied by Federal Products Corporation. A total of twenty inside diameters—two at opposite ends of each bore—are measured, and the alignment of the oil holes in the babbitt liners is checked with respect to

Fig. 3. (Above) Top and bank faces of the blocks are drilled and reamed, and the distributor hole is drilled and reamed on this thirty-five station transfer machine.

Fig. 4. (Right) Automatic gaging assembly built into transfer machine for checking diameters and angularity of the sixteen valve-lifter holes in each block.

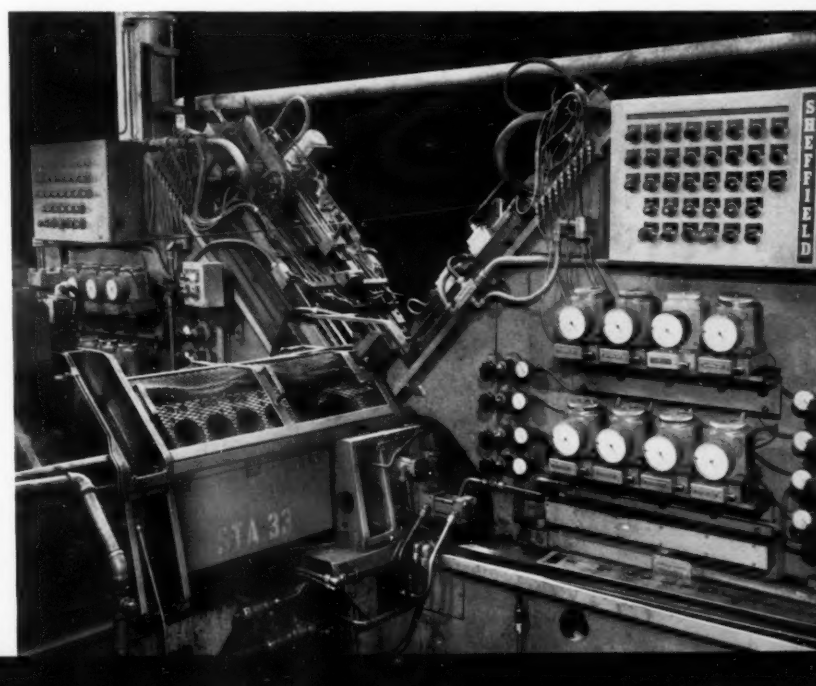
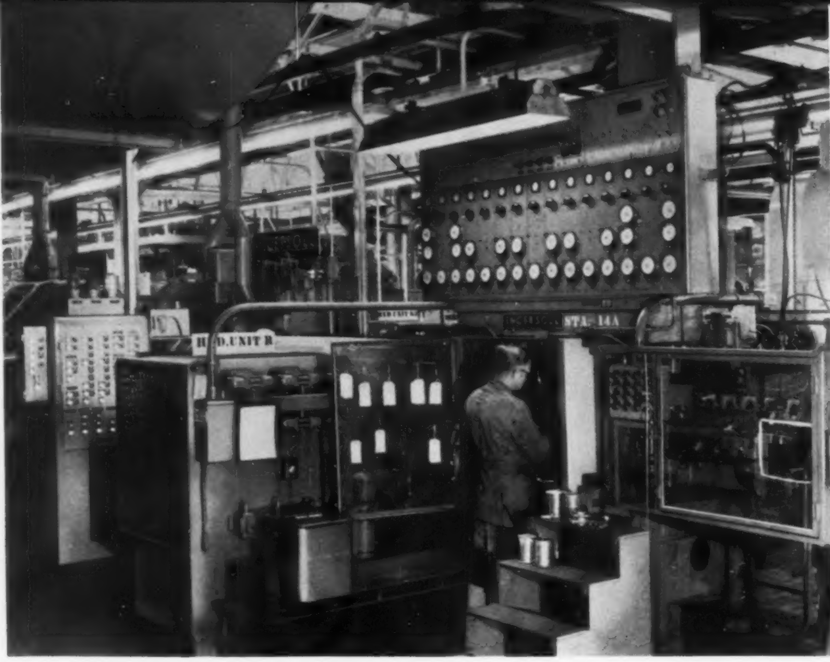


Fig. 5. Finish-bored crank holes and the babbitt cam liners are inspected with this gaging unit. Blocks are classified by marking with various color paints.



the oil holes in the cam bores. Crank bores are checked for size and classified by marking with different color paints. Blocks with oversize, undersize, or misaligned holes are rejected. Signal lights are also provided to give a visual indication of the condition of the block.

In the third section of the Ingersoll transfer machine, the bank surfaces of the blocks are finish-milled, and the cylinder holes are finish-bored (3.9970 inches in diameter). Cylinder boring is performed on alternate blocks at two successive stations. The bank surfaces are inspected for height, flatness, and angularity by means of a manually controlled fixture built into the line.

Cylinder block and lower housing sub-assemblies then pass through a Centri-Spray washing machine equipped with a turntable loading mechanism and twenty-seven block-holding fixtures. Cylinder bores are rough- and finish-honed on two W. F. & John Barnes eight-spindle machines, Fig. 6. In each machine, the blocks are first turned 90 degrees to one side for honing the four cylinder bores in one bank, and then 180 degrees in the opposite direction for finishing the four bores in the other bank. "Electro-Graphic" maintenance detector systems are provided to reduce the electrical maintenance costs.

These machines are equipped with Jes-Cal honing tools and stones. The double-cone type tools are attached to a rigid drive-shaft, eliminating the need for universal joints, and are provided with a fully automatic mechanical sizing device. Self-centering sizing gages, mounted on the drive-shafts above the hones, have carbide-tipped contact points. When the bores have been honed to a diameter that permits entry of the gages, the

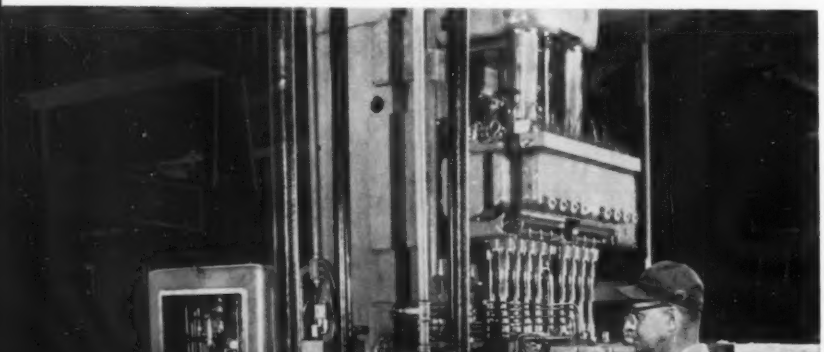
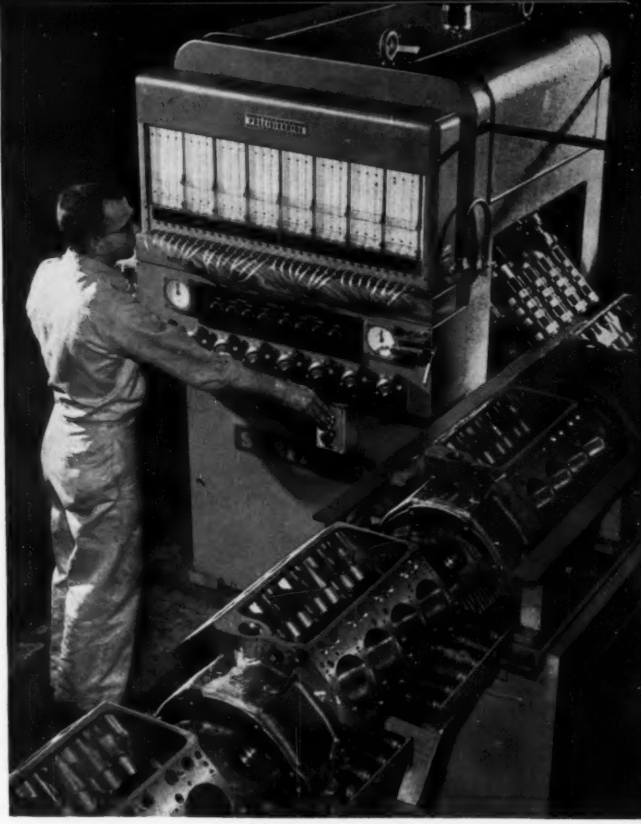


Fig. 6. Eight-spindle, vertical machine for rough-honing cylinder bores. Blocks are first turned on one side and then on the other to complete the eight bores.

stone-holders collapse and honing stops. Vitrified-bond, silicon carbide abrasive stones, 3/8 inch wide by 5/16 inch thick and 3 1/2 inches long, are used. For rough-honing, 180 grain size, R grade, and No. 9 structure stones are specified; while for finishing, 240 grain size, P grade, and No. 9 structure stones are used. An outstanding feature of this honing installation is the use of a water-soluble coolant, Micro-Cool, instead of kerosene, thus eliminating a major fire hazard.

Cylinder bores are inspected for size and stamped on a Sheffield double-bank machine, Fig. 7. Diameters, out-of-roundness, the taper, and bellmouth condition of all eight bores are checked simultaneously. Each gaging spindle has tungsten-carbide wear strips and four sets of jets for checking the bore at different positions. Also the bores are classified at a point approximately 3.500 inches from the top into either oversize, undersize, or one of eleven diameter classifications. Such classifications, identified by letters stamped on the top flange, vary from each other by only 0.00025 inch in diameter. Out-of-roundness tolerance is 0.001 inch, and the taper tolerance, 0.0007 inch.

Cylinder blocks are again washed before passing through a final inspection. Parts passing inspection are automatically loaded into a final Ingersoll transfer machine where welch plugs, dowels, and lower housing are assembled; and the rear of the block as well as the lower housing are finished-faced. First, sealer is automatically applied to the six welch-plug holes from a compound metering unit and tank. At the next station, three core-hole plugs are pressed into each side of the block, and one water-passage plug and one core plug into each bank surface. The vibratory feeding hoppers and chutes for delivering these plugs are seen in Fig. 8.



The plugs are expanded by means of Ingersoll-Rand air tools and inspected at the next station on the transfer machine. An air test of the water chambers for leaks is performed at Station 5, and blocks not passing this test are ejected at the sixth station. At Station 7, the blocks are turned 90 degrees to position the back ends toward the right-hand side of the machine. The four bolts for holding the flywheel housing to the block are tightened at Station 8 and the rear ends of the block and housing are finish-faced at the final station on this transfer machine.

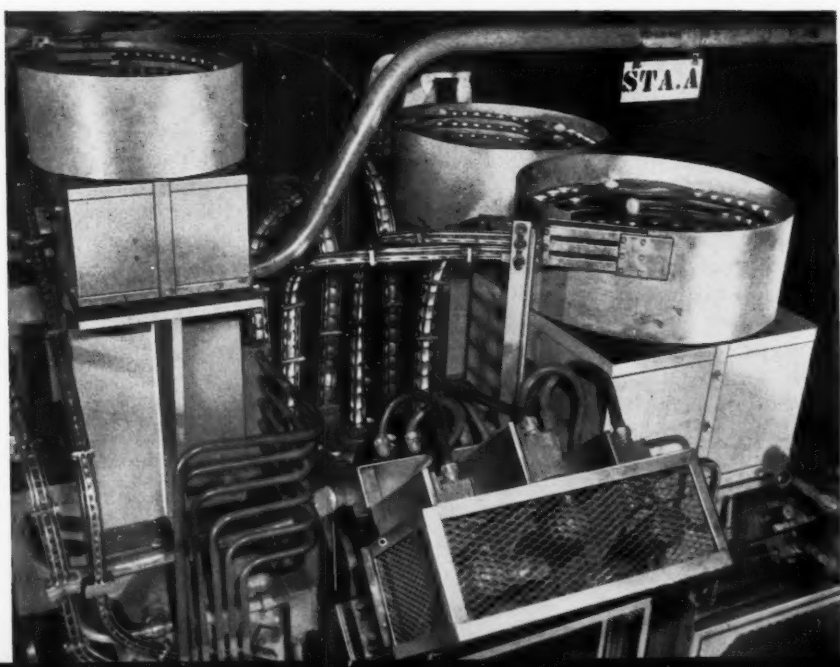


Fig. 7. (Above) Automatic, double-bank inspection machine checks eight bores simultaneously for diameter, out-of-round, taper, and bellmouth condition.

Fig. 8. (Left) Vibratory hoppers and feed chutes provided on top of a transfer machine for delivering various plugs to be assembled into the blocks.

Welding the Lincoln Uniframe Body

M. H. TRYGAR and O. B. SIMMONS
Welding Engineers
Lincoln and Mercury Division
Ford Motor Co.
Wixom, Mich.

LINCOLNS FOR 1958 are being built in the newest and most modern automotive assembly plant in America. This plant, covering 1,300,000 square feet and capable of producing 112,000 cars per year on a straight-time basis, is located in Wixom (Novi Township), Mich., 28 miles northwest of downtown Detroit.

An outstanding feature of the 1958 model Lincolns and Continentals is uniframe body construction. With this type construction, the uniframe includes the entire underbody, structural members, rear-compartment pan, front engine compartment, and engine supports. Then the unitized frame, roof, body sides, front fenders, and rear quarter panels are all welded together to form a complete body shell, Fig. 1.

Increased rigidity and improved safety are important advantages of uniframe construction. Also, all body panels, with the exception of the hood, are painted as an integral unit, thus improving the quality. However, this type design made it necessary to provide special overhead monorail conveyors, body carriers, and similar equipment to handle the heavier bodies and to permit installation of axles, suspension units, shock absorbers, exhaust pipes, and similar components from underneath the body.

Unitized construction also increases the welding problems. The 1957 Lincoln body needed only 3300 spot-welds, while the 1958 model requires a total of 9850 spot-welds. Also, heavier-gage metals are used in the new car—necessitating the welding of materials ranging from two thicknesses of 0.036-inch sheet metal up through two pieces of 0.090-inch thick material. Such welds are made on the same production lines, and frequently with the same portable welding gun. In welding the thicker metals, the capacity of the spot-welding guns is reduced from 200 to approximately 80 spots per minute.

All of the welding guns are air-operated. With 5-inch diameter cylinders, the guns will produce a welding pressure of 1570 pounds with a supply air-line pressure of 80 psi. Where the 5-inch diameter air cylinders cause interference with components of the unitized body, tandem air cylinders 3 1/2 inches in diameter are used. The latter arrangement provides ample welding pressure for the heavier-gage materials. To minimize the chance of shorts or any shunting conditions, the welding guns and adapters are insulated with three wrappings of fiber-glass tape. Each layer of tape is retained by the application of a plastic laminating mix.

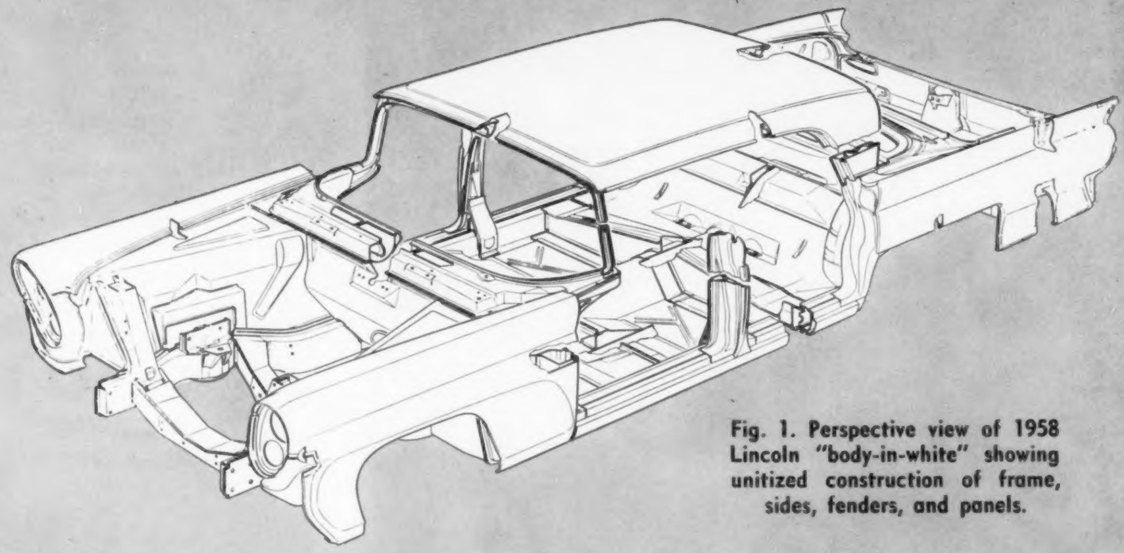


Fig. 1. Perspective view of 1958 Lincoln "body-in-white" showing unitized construction of frame, sides, fenders, and panels.

The number of spot-welds required per car—totaling 9850—has been increased nearly 300 per cent in building the uniframe bodies for 1958 Lincolns. Also, heavier-gage metals are employed. Details of the welding fixtures and methods used at the company's new ultra-modern assembly plant are described in this article.

Stampings used in the uniframe bodies are held to very close tolerances, since excessive thicknesses of the welding flanges would make it difficult to obtain the high quality of welding specified. Also, to insure maximum quality, the Lincoln Division uses a carefully controlled combination of welding pressure, time, and heat. For each variation in metal thicknesses of approximately 0.015 inch, an individual combination of pressure, time, and heat is employed, controlled by push-button.

Considerable research and experimentation were performed to eliminate the need for the operator to select the proper pressure, time, and heat. All that is necessary is to depress the correct button. Each supply air line has its individual regulator, gage, lubricator, and four-way valve. Time is controlled by an attachment on the electronic control panel, and the weld current is selected by means of phase-shift heat controls also mounted on the panel.

The soundness and quality of each weld are insured by the Quality Control Department. It is required that each weld meet the minimum nugget size specifications set up by the American Welding Society, as determined by the peel test. Values of pressure, time, and heat needed for each individual weld are recorded on a card attached to the transformer. These cards also have sketches of the welding electrodes, showing the proper dimensions for tip dressing and the time for tip replacement.

A trace prepared from a weld analyzer and recorder is attached to each card. The analyzer and recorder has a probe that is placed between the welding-gun electrodes. When the gun is actuated, the pressure, time, and current values are relayed from the probe to a Brush recording unit. The graphical trace thus prepared by the recorder gives a permanent record of the welding setup. Each day a trace is prepared and compared with a master, and any deviations are corrected to insure consistently high-quality welds.

Parts are spot-welded into sub-assemblies on various locating fixtures. A merry-go-round conveyor, Fig. 2, contains ten individual underbody assembly fixtures for joining the underbody, floor pan, and front end. A total of 1350 spot-welds are made on each assembly in this operation.

Completed underbody assemblies are removed from the merry-go-round and loaded on a double-chain conveyor leading to the body-truck area. Along the way there is another merry-go-round conveyor, Fig. 3, having ten fixtures for

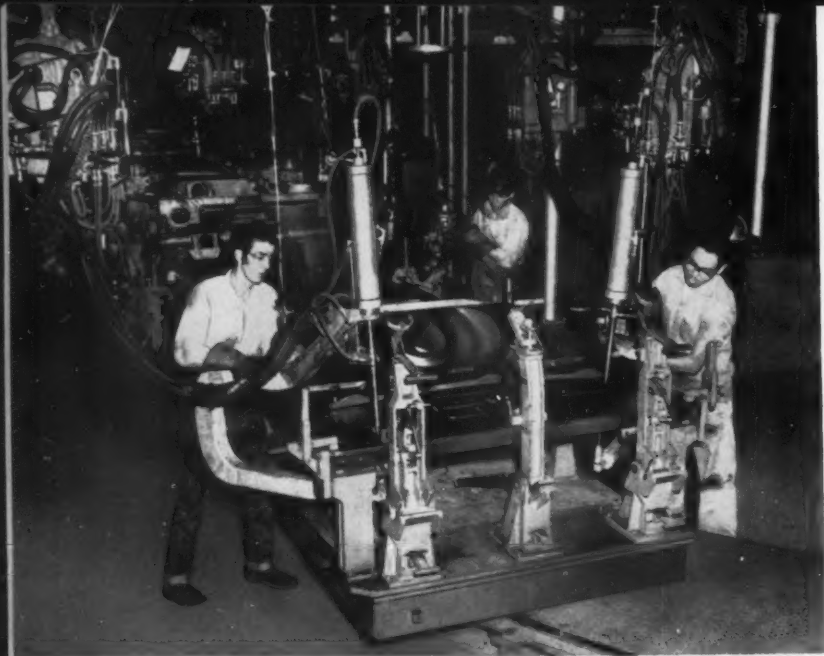


Fig. 2. (Left) Merry-go-round conveyor equipped with fixtures for joining the underbody, floor pan, and front end with 1350 spot-welds.

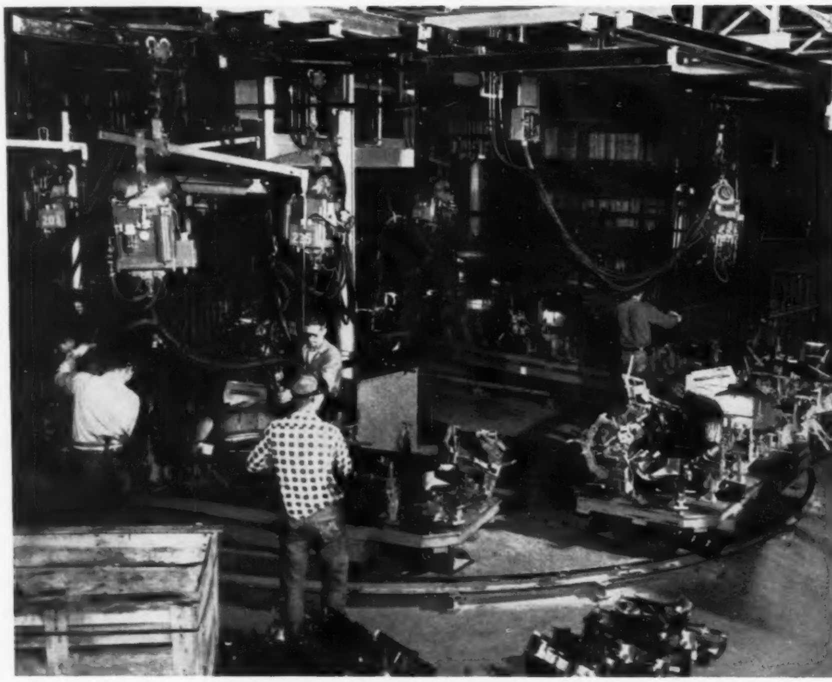


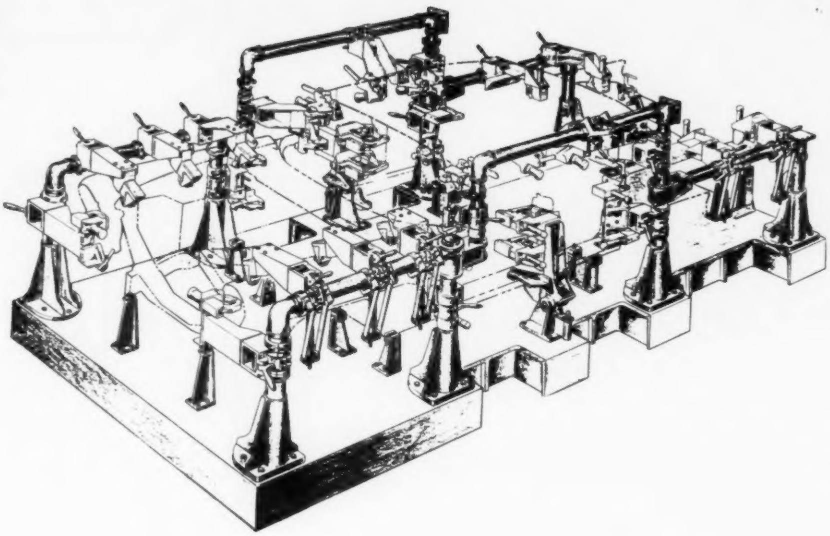
Fig. 3. (Right) Both right- and left-hand sub-assemblies are completed at the rate of sixty per hour on carousel manned by twenty-seven welders.

assembling the body sides. Each side sub-assembly requires 1370 spot-welds made by twenty-seven operators. This carousel can complete thirty right-hand and thirty left-hand sides per hour. Completed side sub-assemblies are taken from the merry-go-round and attached to the moving underbody assemblies by means of toggle clamps.

Underbody, body sides, front fenders, and roof are lifted off the delivery conveyor as a complete unit and placed in one of the six body-framing bucks, Fig. 4, where all of the major components are joined by spot-welding. The one-stage framing-buck method of assembly was chosen as the best way to produce the close dimensional accuracy and structural qualifications specified by the Product Engineering Department. In front of each body buck is a surface plate on which dimensions of the bodies can be checked periodically to insure quality control.

A close-up view of one of the six body-framing bucks is seen in Fig. 5. A total of 586 spot-welds are completed on each body shell in ten minutes with six operators, giving a production of thirty

Fig. 4. Close dimensional accuracy is maintained in completing the basic body shell on a single-stage framing buck.



unitized bodies per hour from the six fixtures. Welding of the wheel housing to the floor pan in these fixtures would be a difficult operation without a special gun mounting. This problem has been solved by mounting the gun on a free-rolling platform and counterbalancing the gun with air. In this way the operator can weld up and around the housing by using only about 2 1/2 pounds of force to raise or lower the gun.

Welded body-shell assemblies are lifted out of the bucks and placed on body skid carriers. Then they are conveyed through conventional respotting, arc- and gas-welding, soldering, and door-hanging operations. The 1958 Lincolns have an all-roll spot-welded roof. Spot-welds are spaced at approximately three per inch to make the roof practically leakproof even if the water sealer were omitted. The roll spot-welding machine completes nearly 700 spot-welds in slightly less than a minute.

A unique feature of the painting installation is the submerging of the entire unit in about 8 to 10 inches of prime dip in a tank. This insures that the unitized underbody receives sufficient rust protection. As previously mentioned, completely painted and trimmed bodies are carried on an overhead conveyor in special fixtures to facilitate underbody assembly of the remaining components.

In conventional automotive assembly plants, these operations are on floor type chassis conveyors, before the body drop. With the suspended assembly system, more accessibility is provided, and the operators experience less fatigue because the automobile bodies are always at the proper working elevations.

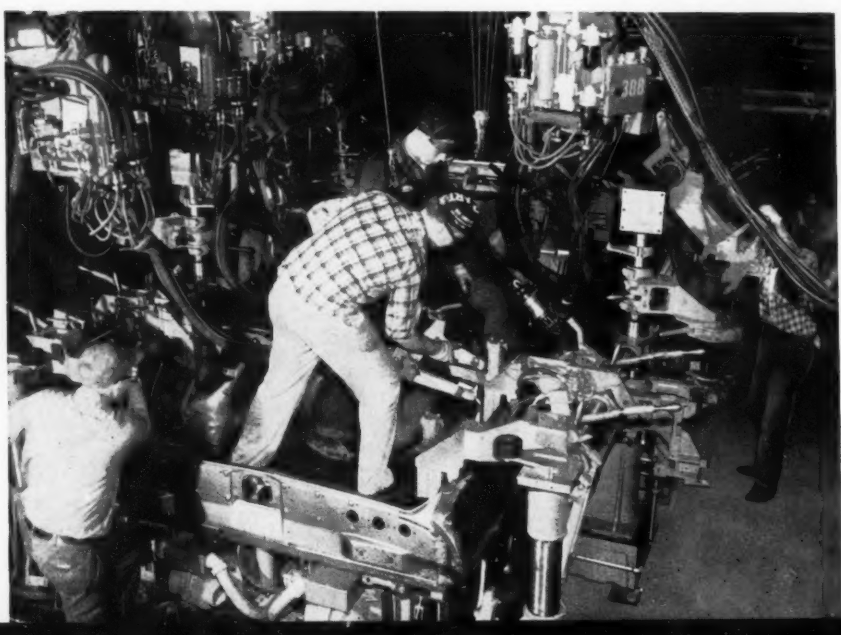


Fig. 5. Six operators complete 586 spot-welds in ten minutes in joining together the underbody, sides, fenders, and roof of the car.

Gear Production

Gears for Buick's new transmission are produced from blanks on standard machines that are completely mechanized and which feature self loading and unloading equipment, work elevating and storing units, grinding wheel compensating devices, and gaging and segregating fixtures.

AN OUTSTANDING FEATURE of the 1958 Buick is an entirely new transmission known as the Flight Pitch Dynaflow. The transmission features three turbines in a five-element torque converter. Two of the turbines are connected to the output shaft through planetary gear sets, while the third is connected directly to the shaft.

A multiple-pitch stator with which the stator blades have an infinite number of angular positions is another innovation. The angle of the stator blades depends on the throttle opening, and has been calibrated to deliver the most desirable combination for over-all performance and economy.

Gears required for the Flight Pitch transmission are being manufactured at lower cost and higher production rates by means of completely automatic processing. Credit for this unique method of manufacturing, as well as other industry-wide, automatic gear-production lines, is justly due Frank Albro, master mechanic at Buick.

A good example of the many such gear-production lines being employed at Buick is the one for the rear-driven pump gear. Blanks for these internal gears are cut off from SAE 1018 or 1112 seamless steel tubing on multiple-spindle bar machines. The blanks are 3.403 inches in diameter by 0.391 inch wide and have a bore 2.518 inches in diameter.

After manually loading into baskets for a stress-relieving heat-treatment, the blanks are completely processed through grinding, turning, boring, broaching, deburring, inspecting, and segregating—on an integrated line controlled by a combination of electrical and mechanical mecha-

CHARLES H. WICK, Managing Editor

for the Flight Pitch Dynaflow

nisms. In addition to self loading and unloading equipment, work elevating and storing units are provided to balance out slower and faster operations. This arrangement also permits shutting down certain machines in the line for maintenance, repair, or tool changes, without the need for interrupting full production from the line.

The entire materials-handling system was designed and built by the F. Jos. Lamb Co., Detroit, Mich. The equipment consists of fourteen elevators, seven storage units, one special sorting and elevating unit, and approximately 350 feet of flexible chuting with line switches and shot-bolts. Electrical controls for this system are independent of the electrical controls on the individual machines and gages on the line. This permits easier and faster maintenance, and any portion of the system can be operated independently. It also makes possible the addition or deletion of machines for engineering changes.

The amount of storage capacity provided in front of each machine was based on the time required for normal tool or grinding wheel changes, or adjustments; and also on the unbalanced machine production capacities. When a storage unit has absorbed its full capacity of parts, a signal is transmitted to the preceding elevator, and part flow is stopped. Through electrical interlocks the

Fig. 1. Gear blanks are mechanically loaded from chute (upper left) into rotary work-carrier of this double-spindle grinding machine.

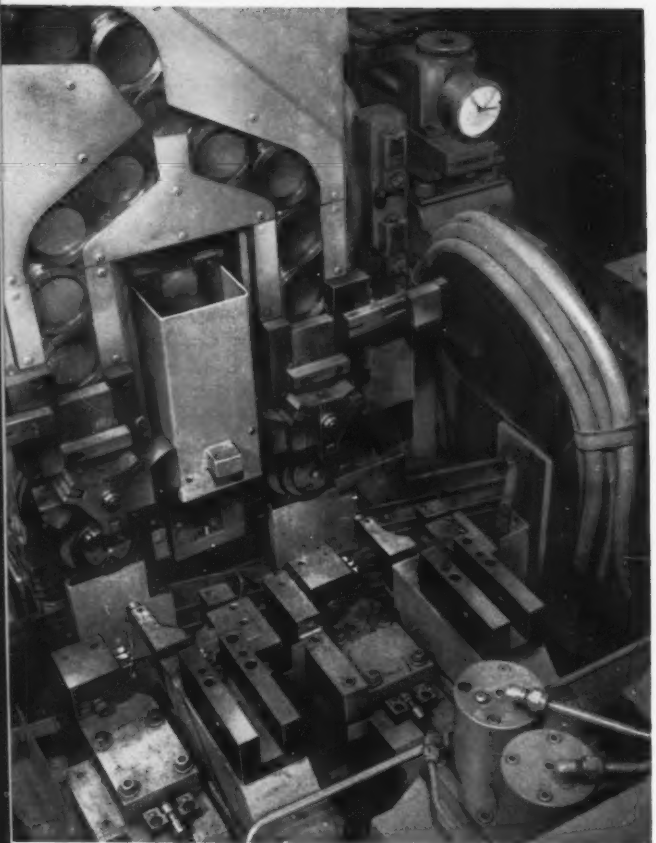


Fig. 2. Hydraulic resetting of the turning tools is obtained with feed-back gaging system on this two-spindle Borematic.

flow of parts through preceding materials-handling units is also stopped. The Lamb FabriFlex chuting is made from tempered spring steel of suitable size.

Balance type line switches are used to control input to the various machines. When a machine is filled, parts in the chute accumulate on a balance bar of the line-switch assembly and depress the bar slightly. This actuates a limit switch and stops the part flow. When the machine again accepts parts and clears the balance bar, the bar returns to its normal off-contact position and flow of parts is again started. Signal lights show the all-clear or non-operating conditions of the various units.

Stress-relieving is performed in a Wayne vertical draw furnace at a temperature of 1100 degrees F. In addition to the blanks for the rear-driven pump gears, blanks for three other pump gears (two external and one more internal) are loaded at random into the furnace. After stress-relieving, the baskets containing various blanks are automatically dumped into a Lamb Parts-Sorting Unit. This unit sorts the blanks according to diameter and width, and delivers them by means of chutes to elevators. All of the Lamb elevators use standard chain with attachments, spaced approximately 12 inches apart, to which are fastened pick-up fingers for elevating the parts. The elevators have ball-and-socket type drive clutches with spring releases in the event of jamming. From the elevators the blanks roll down chutes to Feedall bulk storage and elevating units located at the beginning of each individual gear-production line.

Before being machined, the blanks are inspected for thickness and diameter by passing through a Pratt & Whitney gage. Parts not within the required tolerance of plus or minus 0.008 inch are automatically removed from the line. Acceptable blanks are again elevated and fed by chute to the Gardner double-spindle, horizontal grinding machine seen in Fig. 1. Here both sides of each disc are ground parallel between the opposed, 30-inch diameter abrasive discs.

The blanks are transferred, one at a time, from the loading chute to an opening in the top of the eighteen-station, rotary work-carrier. Ground parts are ejected at the bottom into an unloading chute leading to another Lamb elevating unit. A total of from 0.009 to 0.013 inch of stock is

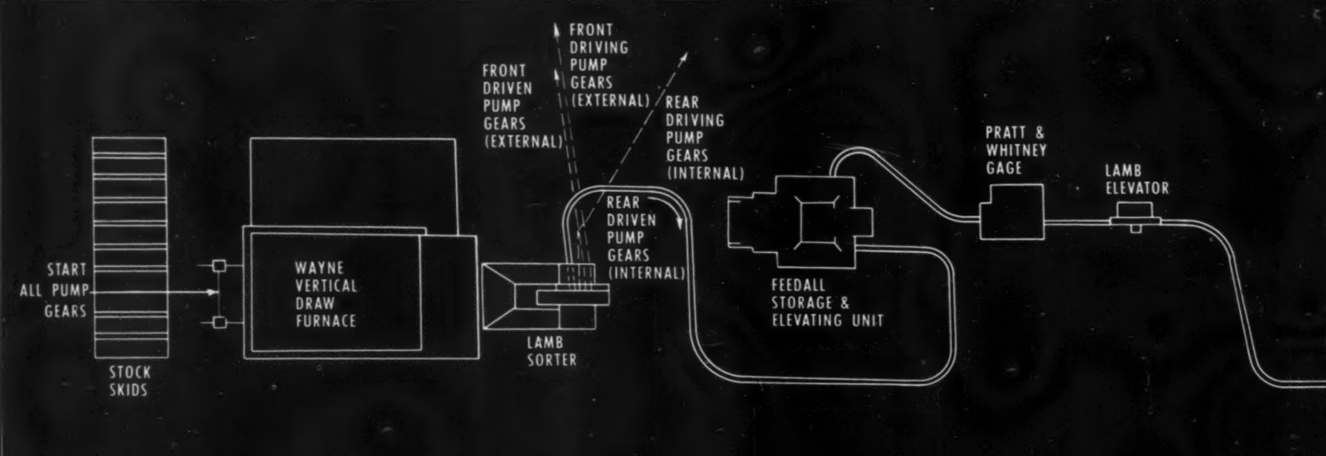
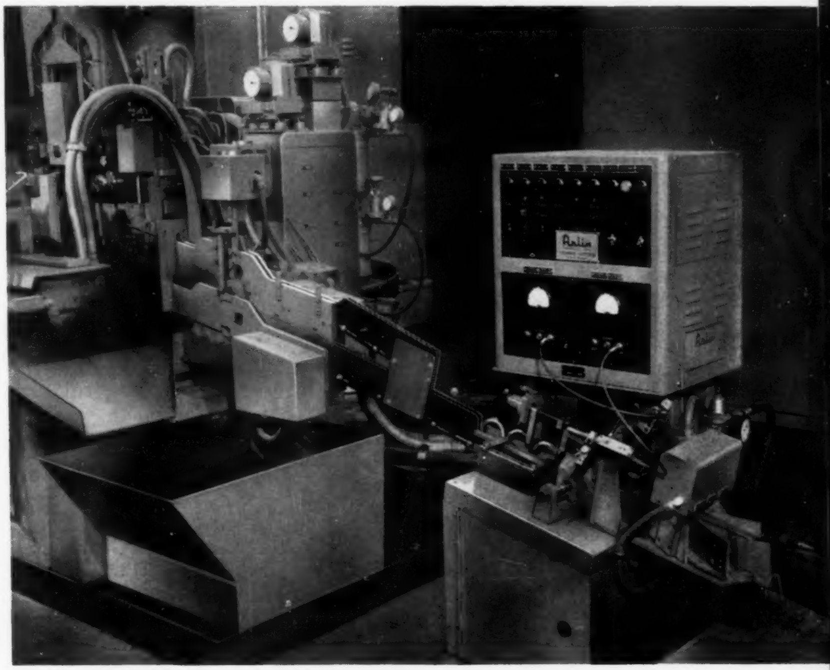


Fig. 3. Electronic gage seen at right checks the chamfers on gear blanks and ejects unsatisfactory parts from the production line.



ground from the blank faces, leaving 0.0025 to 0.0065 inch for subsequent removal in finish-grinding.

Size control is obtained with a Sheffield dual open-jet system and a single Plunjet and gaging anvil sizing attachment. A Lectrolair feed-in machine-control unit feeds the abrasive discs toward each other when required to compensate for wear. Cluster type diamond, swinging type dressers which are operated by a combination air-hydraulic system periodically true the abrasive discs. Blanks are fed to the grinder by demand. Coolant is introduced to the grinding areas through the two hollow spindles of the machine, and a BarnesdriL magnetic separator is provided so that the coolant can be recirculated.

Rough-ground blanks roll down a chute from the elevator into the top of a Lamb Spiral Storage Unit. This particular storage unit is equipped with two circular tiers, or decks, and is capable of banking about 800 blanks. Parts roll into the center of the top tier of the unit and travel through a spiral track (carried by a drive plate) to the outer edge of the tier. From this point the blanks are conducted by gravity chute to the center of the next tier directly below. The banking units can be provided with from one to five tiers, depending on the amount of storage required. Two drive speeds are provided—the lower speed for storing parts when the machine demands are satisfied or the machine is down for service. The higher speed is engaged to carry the parts rapidly through the unit when it is necessary to satisfy machine demand.

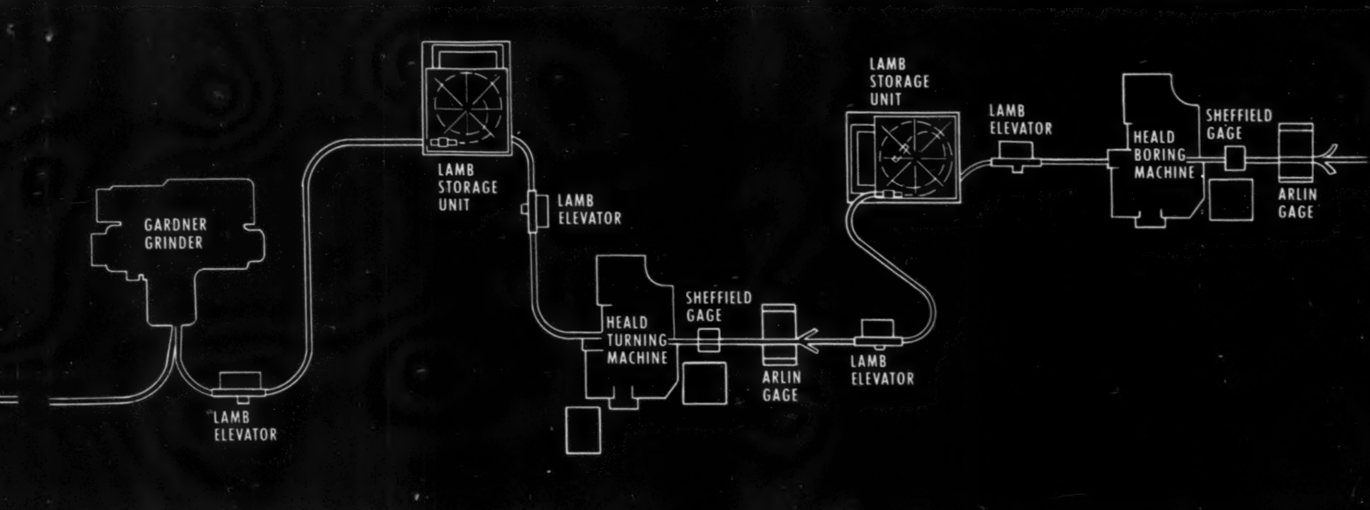


Fig. 4. Internal teeth are broached in three blanks at a time on this 20-ton, 66-inch stroke, pull-down type broaching machine.

From the bottom of the storage unit, the parts are again elevated and roll down a chute to a Heald two-spindle, single-end, precision boring machine, Fig. 2. On this machine the blanks are turned to a diameter between 3.388 and 3.389 inches (removing about 0.015 inch of stock), and both ends of each blank are chamfered to 0.018 inch by 45 degrees.

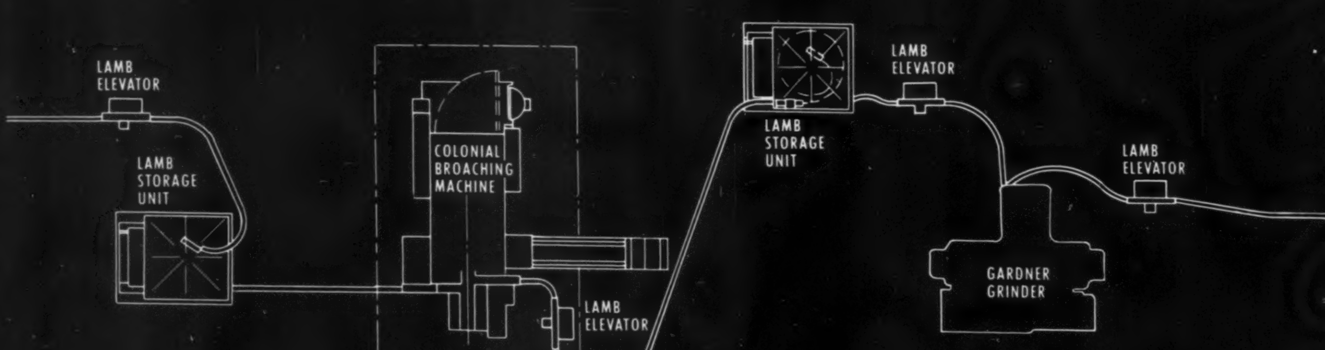
The single column of parts being fed to this machine is divided in two, one column above each spindle, by means of a special loading mechanism designed by the Heald Machine Co. and Frank Albro. The loading arm moves up and down, as well as in and out, to transfer two parts at a time from the overhead chutes to the spindles. Air-operated, rotating-stake fixtures are used to clamp the blanks on the spindles. Triangular carbide inserts perform the turning, while square carbide inserts do the chamfering.

A Sheffield Lectrolair feed-back gaging system is provided with two sets of limits. The wider set, using full tolerance, is for rejecting parts. The second set uses closer tolerances for adjusting the tools before they get out of full limits. They do this by feeding the turning tools toward or away from the work-pieces, in increments of 0.0002 inch, as required. This is accomplished by pivoting the turning-tool-holder bars hydraulically. The gaging system also automatically stops the machine if two successive parts are produced that do not pass inspection with respect to the full tolerance limits.

Turned gear blanks are mechanically ejected, and roll down a chute into an Arlin electronic gage, seen at the right in Fig. 3, which checks the chamfers. Unsatisfactory parts are ejected from the line, while acceptable blanks roll down another chute to an elevator and storage unit.

From the bottom of the storage unit, the blanks are again elevated and fed by chute to a second Heald two-spindle, single-end precision boring machine. Here the work-pieces are bored to a diameter between 2.5325 and 2.5335 inches, and both sides are chamfered to 0.018 inch by 45 degrees. From 0.0125 to 0.0175 inch of stock is removed from the bores. Loading, feed-back gaging, and tool compensation on this machine are similar to the equipment provided on the preceding Borematic used for turning.

Bored blanks are again elevated and pass through another Lamb Spiral Storage Unit before



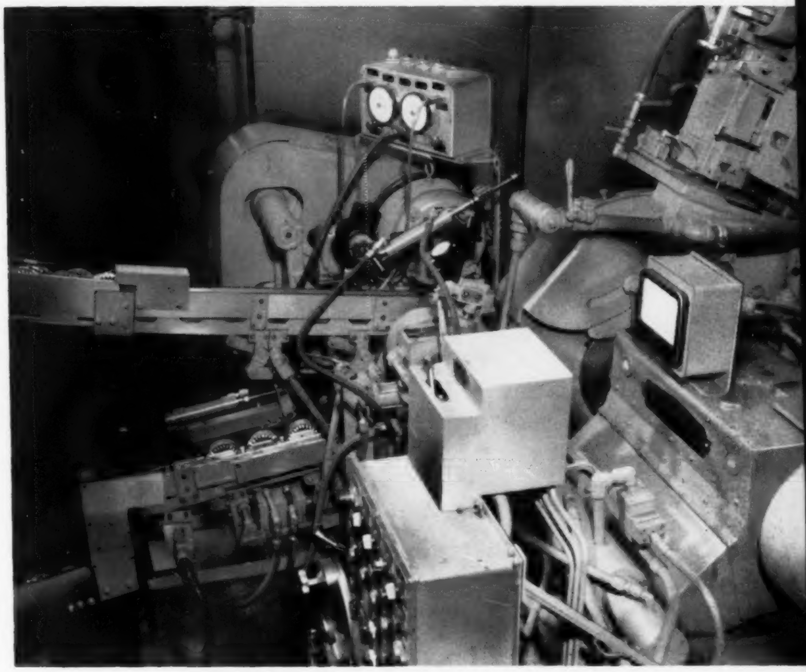


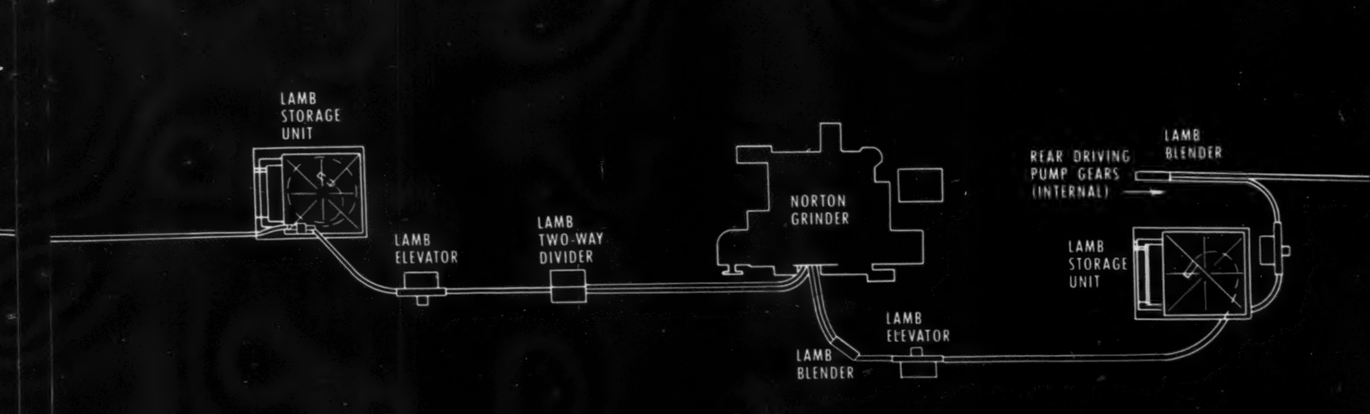
Fig. 5. Outer peripheries of gears are finished on this cylindrical grinder. Turret type work-holder can be seen in heading illustration.

being fed to the Colonial 20-ton, 66-inch stroke, pull-down broaching machine shown in Fig. 4. A special section of twisted chute (left) reorients the parts from a rolling to a sliding position. Three parts are machined at a time, broaching the twenty-seven internal teeth of each gear to size, the diameter formed by the tooth tips measuring between 2.5420 and 2.5430 inches. A nesting type shuttle fixture transfers a stack of three blanks from the loading chute to the broaching position.

After broaching, the gears are separated and fall onto a special "water-fall" chute. The gears are then elevated into a storage unit having a capacity for 500 parts. Samples of the broached gears are removed periodically and taken to the laboratory for a complete inspection.

Finishing of the gear faces is done on another Gardner 30-inch, double-spindle, horizontal grinding machine having the same type of mechanical loading, sizing control, and unloading equipment. Surface finish is held to a maximum of 20 micro-inches in this operation. Parallelism of the faces is maintained within 0.0005 inch, and the surfaces are held square with the gear axis within 0.001 inch total indicator reading.

After being elevated and fed through another 500-part storage unit, the gears are mechanically loaded into a Norton 10- by 18-inch cylindrical grinding machine, Fig. 5. Here, the outer peripheries of the internal gears are finish-ground, two at a time, removing about 0.023 inch of stock from each part and producing a 20 micro-inch finish. Gears rolling from the loading chute are



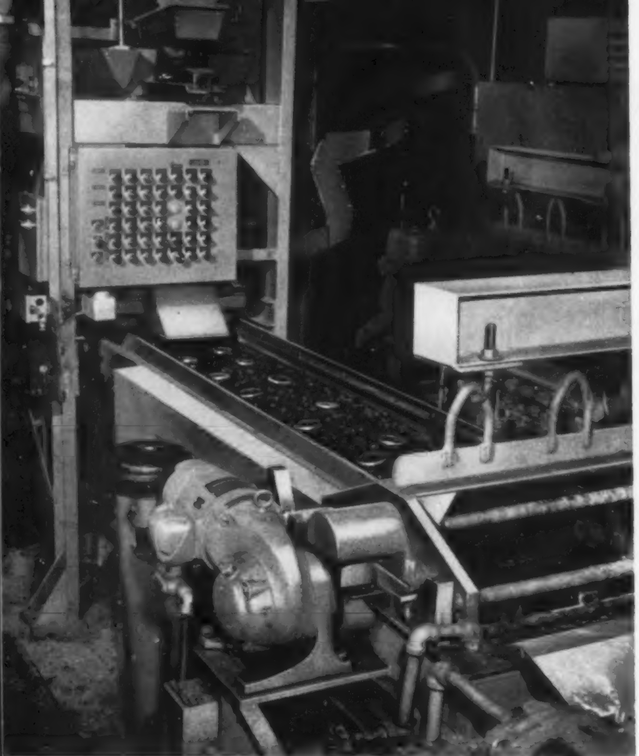


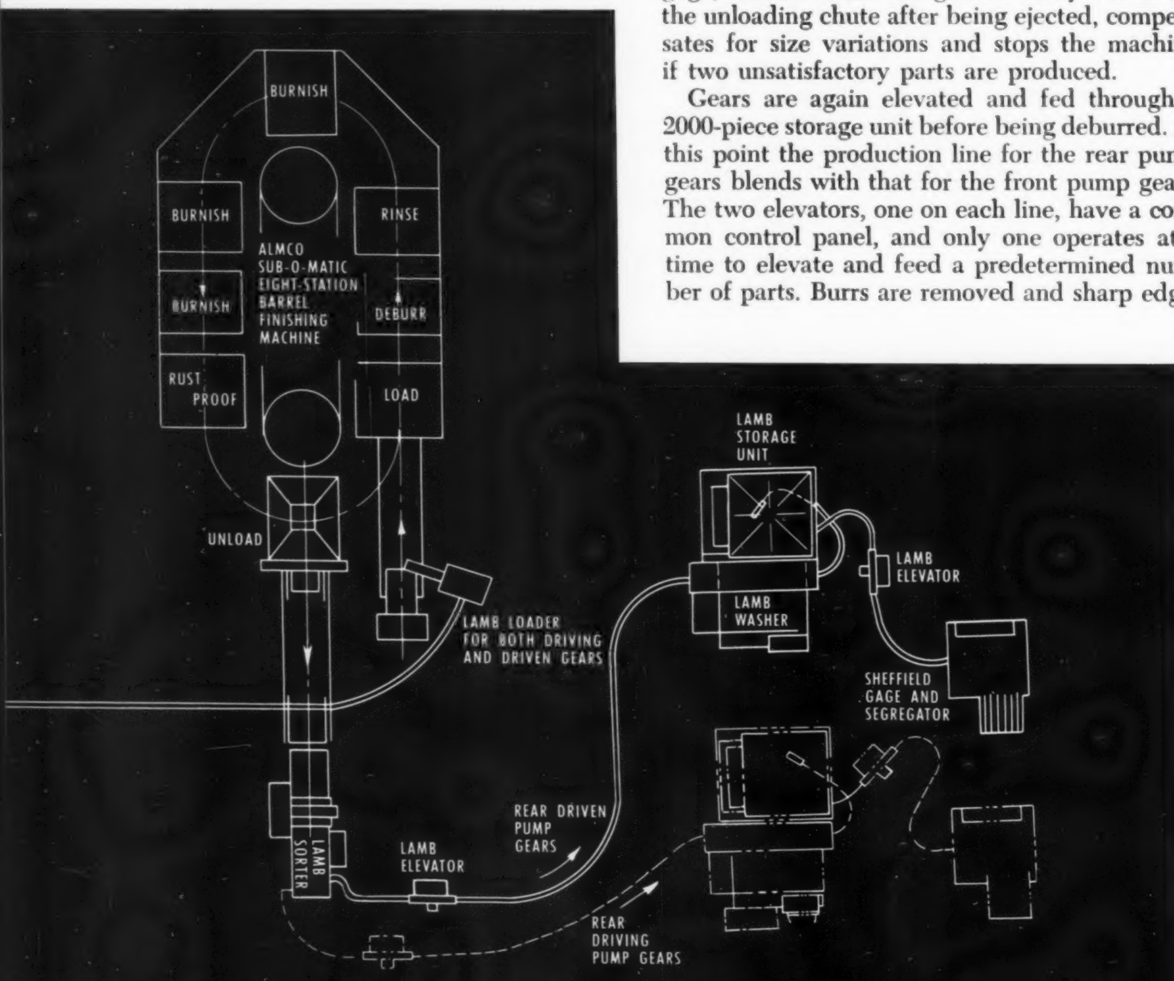
Fig. 6. Abrasive chips and work-pieces are loaded into barrel from a conveyor prior to burr removal operation on this finishing machine.

divided into two lines, each having an equal number of parts. This is accomplished with a Lamb Shot-Bolt Type, Two-Way Divider, controlled by a switch in each line. One gear from each line falls into one of the three openings in a turret type work-holder, seen in the heading illustration.

A special hydraulically operated tailstock pushes the gears, two at a time, onto a Martin expanding arbor mounted on the live spindle headstock and holds them in this position while grinding. After grinding, a spring-loaded ejector pushes the gears back into the rotary holder. When the holder has been indexed, the gears fall into the unloading chutes. Both lines of parts pass through a blender, which repositions them into a single line.

A straight-sided grinding wheel, 30 inches in diameter by 7/8 inch wide, is used. The machine is controlled by an Arnold continuous, caliper type gage having a Federal Electricator tolerance unit and electronic circuit. A Federal aftergage, which checks the gears as they roll down the unloading chute after being ejected, compensates for size variations and stops the machine if two unsatisfactory parts are produced.

Gears are again elevated and fed through a 2000-piece storage unit before being deburred. At this point the production line for the rear pump gears blends with that for the front pump gears. The two elevators, one on each line, have a common control panel, and only one operates at a time to elevate and feed a predetermined number of parts. Burrs are removed and sharp edges



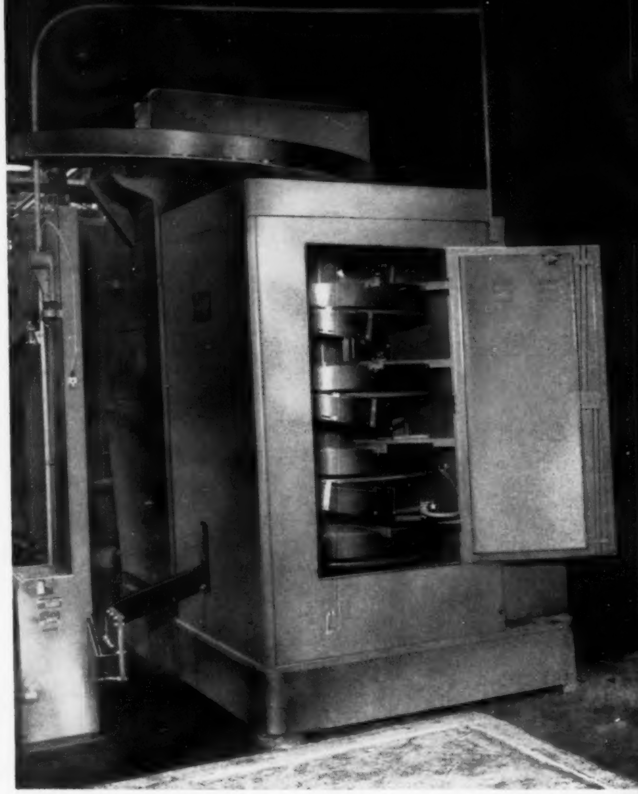


Fig. 7. One of the many Lamb Spiral Type Storage Units provided throughout gear-production line. An elevator can be seen at the left.

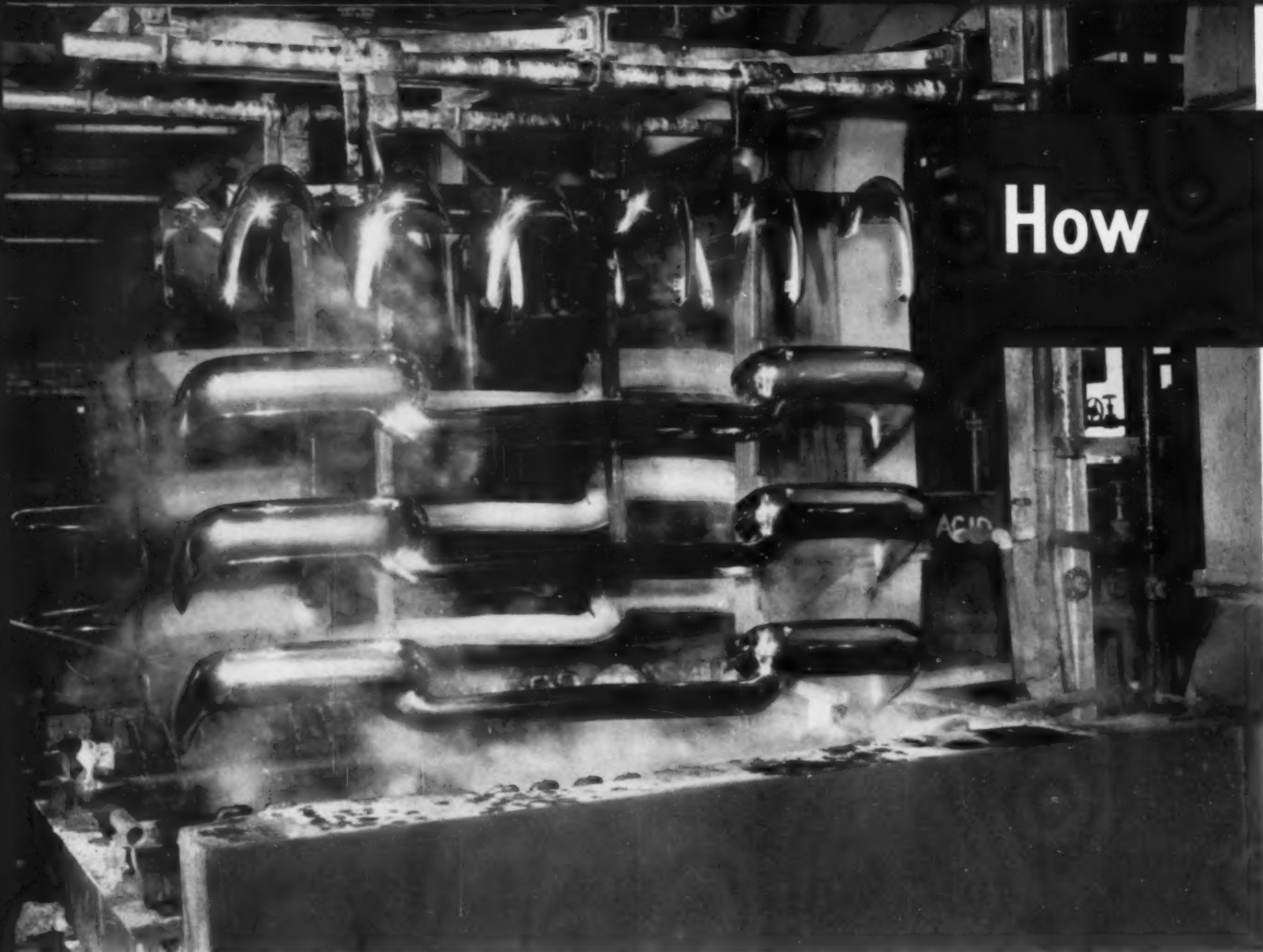
are broken on a Sub-O-Matic eight-station, submerged type barrel finishing machine made by the Almco Division of Queen Stove Works, Inc. All operations on this machine are completely self-actuated with the exception of mounting and removing the barrel covers, which must be done manually.

A controlled amount of abrasive chips (about 400 pounds) falls onto a belt conveyor from an overhead storage hopper, and about 400 gears per barrel drop onto the chips from the loading chute, as seen at the center in Fig. 6. The hopper holds about 800 pounds of chips, which are recirculated. Rotary screens having various-size holes sort the chips, and those too small to be used further are rejected.

From the conveyor the gears and chips fall into one of the barrels, and the lid is clamped in place. The barrels are alternately elevated and lowered by a hydraulically controlled center frame and transferred to successive tanks by an overhead walking beam conveyor. Solutions in the various tanks are used for cleaning, rinsing, deburring, and rust-inhibiting treatments. At the unloading station the parts and chips drop onto another conveyor belt. A permanent magnetic drum and cleated belt are used to separate the gears from the abrasive. Also, a Lamb sorting unit is provided to separate the two different gears, orient them, and feed them in a rolling position back to their respective lines.

Deburred gears are elevated to a Lamb Parts Washer and 2000-piece storage unit, Fig. 7. From the bottom of the Spiral Storage Unit, the gears roll down a chute to another elevator (seen at the left), and are fed to a Sheffield gaging and segregating machine, Fig. 8. On this machine the gears are segregated into six width classifications for matched assembly with the driving pump gears. The classifications are oversize (more than 0.3765 inch wide); Class A, 0.3760 to 0.3765 inch wide; Class B, 0.3755 to 0.3760 inch wide; Class C, 0.3750 to 0.3755 inch wide; Class D, 0.3745 to 0.3750 inch wide; and undersize (less than 0.3745 inch wide). A Lectrolair memory circuit is employed to open the gate to the proper chute after gaging, and the gears are stacked as shown. Final inspection of acceptable gears is completed with hand gages.

Fig. 8. A memory circuit machine for inspecting completed gears and segregating them into six classifications according to their width.



How

AUTOMOBILE BUMPERS have evolved into increasingly important elements in car styling. More often than not, a model changeover will include a bumper redesign. At the same time, high-horsepower travel on congested roads emphasizes the need to preserve the utilitarian nature of the item. One major bumper supplier is the Sharonville, Ohio, plant of the Electric Auto-Lite Co. Processing highlights are described here.

Incoming stock is high-tensile steel sheet, 0.093 to 0.120 inch thick. Ordinarily, sheet width is calculated to give two developed blanks. This saves time during the first steps. Strains and waviness in the material are removed by running it through a roll-leveling machine. Stenciled with the customer's part number, sheets are now ready for flat polishing.

A Hill Acme machine, 100 feet long and having sixteen stations, comprises the flat-polishing line. There is a coated abrasive belt at each station, polishing the sheet with progressively finer grit to a surface finish of 7 micro-inches or less. The line is divided into a roughing section and a finishing section. Upon leaving the roughing section, the sheet is cooled with water and inspected as it enters the finishing section.

The first belts in the line have a grit size of 80. Successively finer grits are used in order to produce a satisfactory finish. Surface speed of the sheet is approximately 50 feet per minute. Rollers at the various stations maintain a suitable pressure against the work.

In Fig. 1, a sheet can be seen in the foreground emerging from the last flat-polishing station. When run out fully on the roller table, the sheet is shifted automatically to another roller table, seen in the background. There the sheet, moving to the left, enters a phosphatizing and soap-coating line.

Periodically, a flat-polished sheet is brought to a Profilometer, Fig. 2, where surface finish is checked. The large duct behind the instrument is part of a Roto-Clone system. This is a hydrostatic precipitator which handles the exhaust from the flat-polishing stations. Air is washed before being discharged outside the plant. Sludge is sucked out and conveyed to a hopper.

Phosphatizing and soap-coating is a six-stage,

Auto-Lite Produces 1958 Bumpers

CHARLES STARZMAN, Methods Engineer
Electric Auto-Lite Co., Sharonville, Ohio

continuous-spray treatment. The line, installed by Ransohoff, handles the sheet at a speed slightly greater than that of the flat-polishing section to insure clearance throughout the line.

Sheets are supported and advanced over the tanks for the various stages on discs grouped on revolving shafts. In this way, the bottom as well as the top of the sheet can be treated. Between each tank, the sheet travels through a set of pinch rolls. The first two stages are, respectively, a hot spray-cleaning and a hot-water rinse. A standard phosphatizing solution is applied in the third stage, followed by another hot-water rinse in the fourth.

In the fifth stage, the soap-coating is applied by spray, serving primarily as a lubricant. To obtain a uniform coating thickness, the sheet passes between two air "knives" which blow off excess soap. The last stage is a steam dryer and blower.

Now fully prepared, the sheet is brought to the press area. The first press blanks the sheet, and the second press draws it to the bumper form. A close-up view of the front of the second press appears in Fig. 3. This is a 700-ton Lake Erie. Blanks are transported by fork truck from the first press and are deposited on the chain table seen in the foreground. These chains are moved intermittently to advance the stacks of blanks to loading positions.

Press-line procedure will, of course, vary somewhat for different styles of bumpers following the drawing operation. Generally, trimming, flanging, restriking, and piercing are involved. Fig. 4, for example, shows the rear of a 500-ton Clearing press. Tooled with two die sets, the press progressively trims off excess metal and pierces bracket-bolt holes. (Some styles of bumpers, instead of being pierced, have a mounting

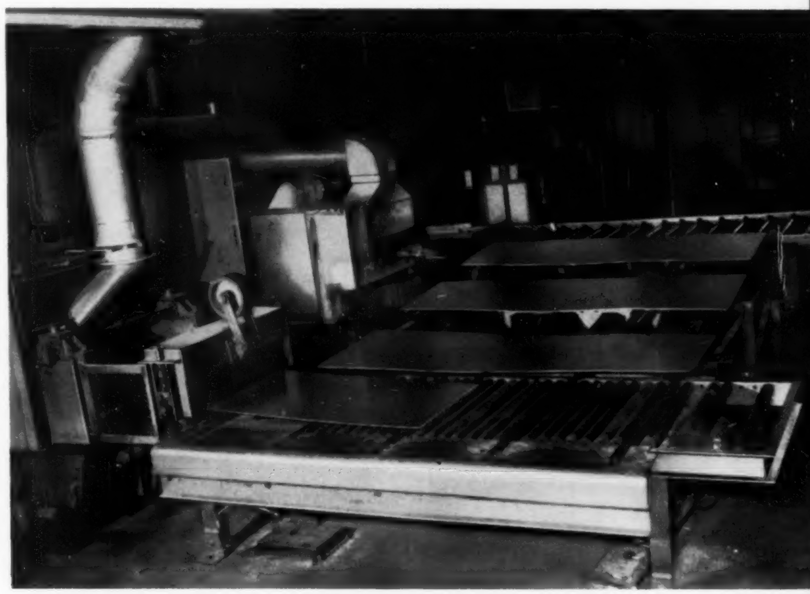


Fig. 1. As the sheet leaves the flat-polished line, it is shifted to a parallel line, where, flowing in the opposite direction, it is phosphatized and soap-coated.

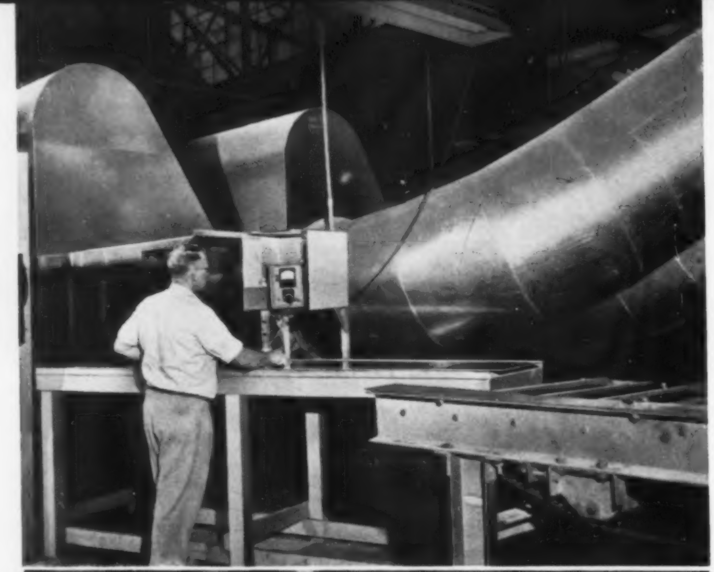


Fig. 2. Periodically, one of the sheets leaving the flat-polishing line is brought to this inspection station for a check on the surface finish.

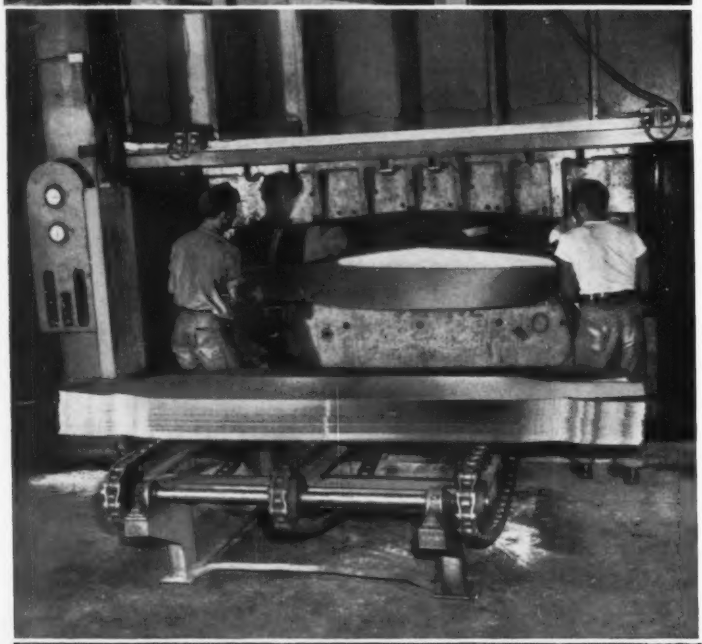


Fig. 3. Already flat-polished, phosphatized, soap-coated, and blanked, the work is being loaded into the press for the drawing operation.

Fig. 4. Two die sets in this press progressively trim and pierce the bumpers. The tank in front of the bolster supplies air to lift out cylinders in the dies.

bracket welded to the inside of the bumper. Such bumpers are shunted by monorail to another building, where the welding can be carried out in an atmosphere free from contamination.)

Now the work undergoes contour-polishing where it is necessary. Because of its shape, three polishing steps may be required: end, rotary, and straight-line. In end-polishing, the bumpers travel front-forward between two eight-station rows of abrasive polishing wheels. These wheels polish the ends of the bumper. Each wheel is directed at a particular section of the end contour.

Rotary-polishing, Fig. 5, finishes the top flanges of the bumper. Here the work is handled on a continuously rotating "merry-go-round." In circling each bumper passes under eight wheels, each directed at a particular section of the flanges.

The last step, straight-line polishing, finishes the top and front of the bumper. Here the work is carried on a pallet, moving endwise with the front up. The pallets advance over one side of a long rectangular table, passing under eight polishing wheels. Then, upon reaching the end of the table, each pallet moves over a circular platen which shifts it to the other side of the table. Pallet movement there is in an opposite direction, and the bumpers pass under a second line of eight wheels.

All polishing wheels are built and maintained by a special department in the plant. They are made of sisal, emery of various grain sizes, and glue. Each wheel is supported in an adjustable stand and is individually motor-driven. Thus, the polishing lines are readily adapted to production changeovers.

From the polishing area, bumpers enter one of two automatic cleaning and nickel-plating lines. Cycle time here is approximately one hour. Bumpers are stacked on racks, four-high, which convey them over a series of processing tanks. The lines move intermittently, and there is a rack of bumpers in work at each tank all the time. All racks descend together, immersing the bumpers in their respective tanks for a designated interval.

A view of the line installed by Hanson-Van Winkle-Munning appears in Fig. 6. The first two tanks of the line are soak cleaners and have a temperature of 200 to 205 degrees F. The third tank, also at 200 to 205 degrees F., is a wetting agent, and the fourth tank, also at this tempera-

Fig. 5. The polishing wheels hit the flanges of the bumpers as they circle on the machine. This is one of three steps in contour-polishing.

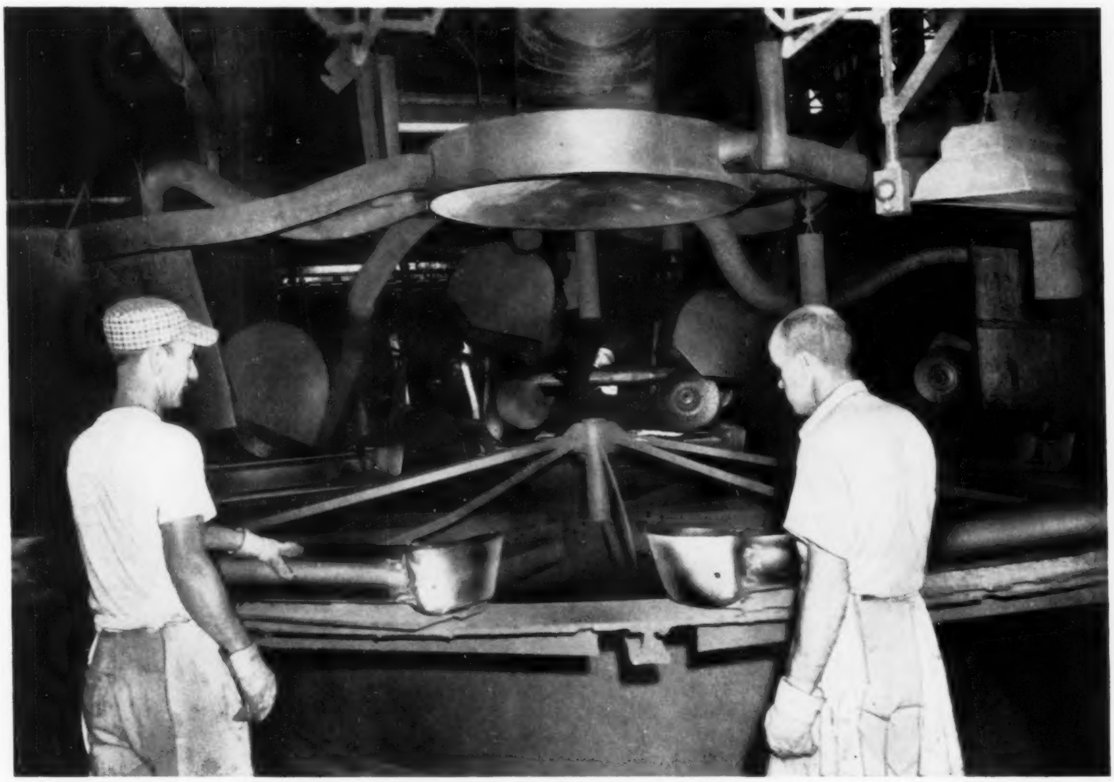


Fig. 6. Leading rack of bumpers has just emerged from the nickel-strike tank. The thin layer of nickel prevents oxidation.

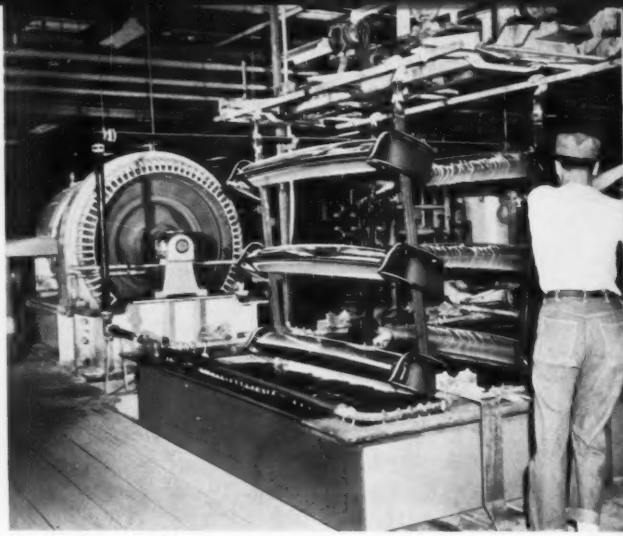


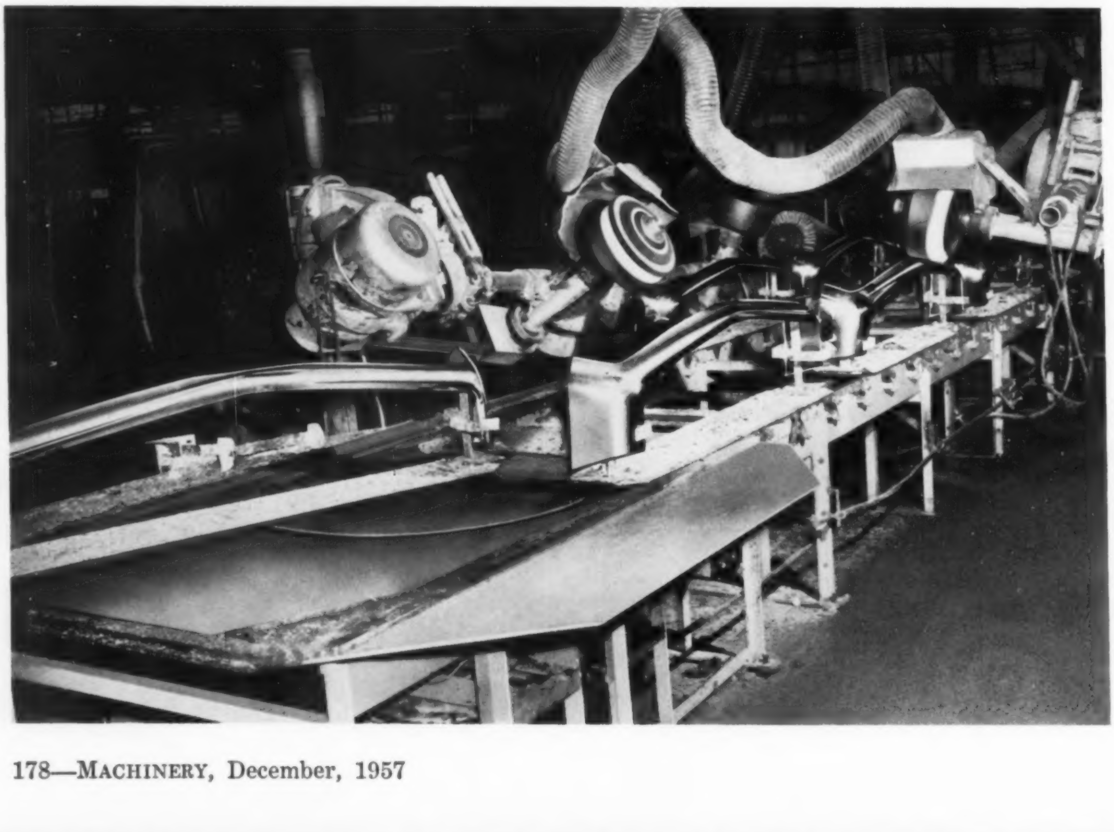
Fig. 7. The bumpers receive the bright nickel plating. This layer provides a lustrous surface over the semi-bright layer.

ture, is an electrocleaner. In it, the bumpers are the anodes, and steel bars are the cathodes.

Following a warm-water rinse and spray in the fifth tank, the bumpers receive an electro-acid etch in the sixth tank. Again, the bumpers are the anodes. Cathodes are sheets of lead. The solution—sulphuric acid—cleans and activates the bumper surface. A cold-water rinse follows.

In the next tank (the one directly beneath the leading rack of bumpers in Fig. 6), the bumpers receive a nickel strike. This is a thin deposit of the metal to prevent oxidation and to give the layer of nickel applied later a good surface to which to adhere. The strike solution has a high chloride content and is kept at a temperature of 125 to 130 degrees F. Here bars of nickel are the

Fig. 8. In straight-line buffing the bumpers move on pallets along one side of table, then return on other side. Layout gives access to entire front and top surface.



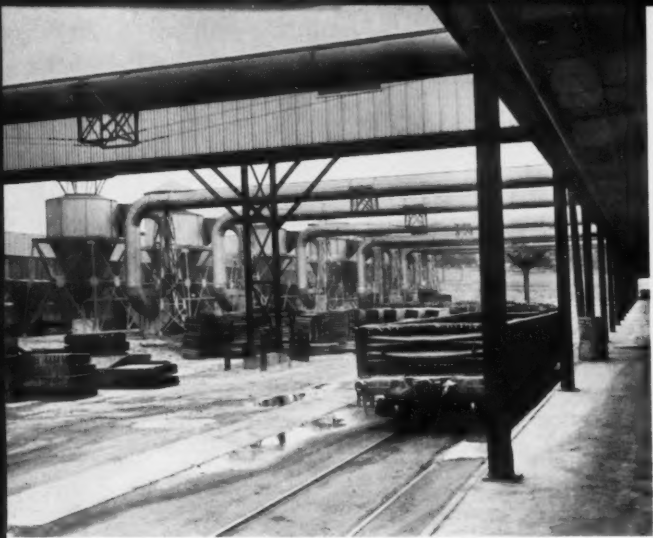


Fig. 9. This ten-unit cyclone system outside the plant takes the exhaust from all contour-polishing and buffing machines.

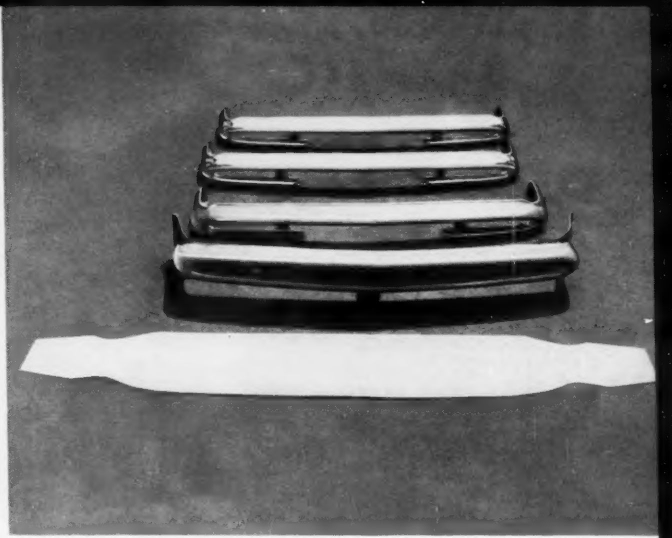


Fig. 10. Progressive steps in making a bumper for a 1958 automobile, from the developed blank to the chrome-plated product.

anodes, and the bumpers are the cathodes. Any loose particles of nickel left on the bumpers are next removed in a cold-water reclaim rinse in the seventh tank.

At this point the bumper rack terminates its automatic movement and is transported by a manually operated crane through the remainder of the cycle. The next two tanks are a semibright plate and a bright plate. They deposit a 0.0015-inch layer of nickel. Of this the semibright thickness is 80 per cent and the bright thickness, 20 per cent. In both tanks bars of nickel are the anodes, and the bumpers are the cathodes.

The semibright plating serves to give good physical properties, and the bright plating serves to reduce the amount of subsequent buffing. In Fig. 7, a rack of bumpers is shown being raised from the bright tank. The generator furnishing the current for the electroplating (10,000 amperes) is visible behind the tank. Similar generators are installed at all other tanks in the line where an electrochemical action takes place. Following the bright plate, the bumpers enter a reclaim rinse tank and finally a hot-water rinse and spray tank.

Buffing is next. Physical equipment and procedure here parallels that found in the contour-polishing area. In addition, a final "color" buffing eliminates any of the laps left by the previous steps.

The buffing wheels, of course, are different from the polishing wheels, being built up of scrap rags sewn in spirals. A view of the straight-line buffing operation appears in Fig. 8. In the center of the illustration can be seen the circular platen which shifts the pallets from one side of the table to the other.

The exhaust ducts seen above each buffing station are part of an elaborate network over the entire buffing and contour-polishing areas. These ducts lead to a ten-unit cyclone system outside the building, as shown in Fig. 9. Each unit is a centrifuge, using a changing velocity to separate the dust from the air.

Final processing step is chrome-plating. The heading illustration shows a rack of bumpers over a tank in one of two duplicate lines. In the first tank in the line, the work is immersed in an electrocleaner having a temperature of 200 degrees F. Bumpers are the cathodes, and steel bars are the anodes. The second tank is a water rinse and spray, and in the third tank, the work is given a sulphuric-acid etch. This activates the nickel surface to accept the chromium. Bumpers are the cathodes, and sheets of lead in the tank are the anodes.

After another rinse and spray, the bumpers enter the chromium-plating solution. As previously, bumpers are the cathodes, and sheets of lead are the anodes. In the immersion interval of about three minutes, the required 0.00001-inch layer of chromium is deposited.

Next, the bumpers are given a reclaim rinse. The rinse water flows continuously through an ion exchanger where it is purified. Evaporators boil down the rinse solution and return it to the plating tank. The cycle ends with a hot-water rinse in the final tank.

A progression view of one of the bumpers now in production by Electric Auto-Lite is shown in Fig. 10. In the foreground is the developed blank. The stages behind it show the bumper after drawing, after trimming, after nickel-plating, and after chrome-plating.

New

Technicians check out a finished transmission in the plant's laboratory. Front end of transmission is coupled through engine-block section to a dynamometer.

Before entering the transfer lines, transmission cases are provided with holes and pads in this qualifying operation.

TURBOGLIDE TRANSMISSION production at the Chevrolet-Toledo plant makes manufacturing methods of only a short time back as dated as the old gear-shift lever in the passenger car floorboard.

New this year, the Turboglide is a non-shifting, variable-pitch torque converter having three turbines and two simple planetary gear sets. It is turned out en masse in the plant's two well equipped buildings. One structure contains die-casting and forge areas, and the other, press, machining, assembling, and testing areas.

Aluminum die-castings find extensive use—so much so, that the curb weight of a car with Turboglide is but 4 pounds more than the same car equipped with a standard three-shift transmission (in contrast to the 92 pounds added by the Powerglide option). Heaviest and biggest of these die-castings is the main transmission case, weighing approximately 14 pounds. In Fig. 1 a case is shown after being ejected from the movable die member of the die-caster.

Largest Die-Caster in Auto Industry

The machine, a horizontal cold-chamber Cast Master, has a locking pressure of 1200 tons. It is one of the largest die-casters in use in the automotive field. Cycling is entirely automatic and is started from a push-button which operates a slid-

Chevrolet Transmission Plant Now in High Gear

Anyone who wants a comprehensive picture of modern metalworking would do well to study the Chevrolet operation at Toledo, Ohio. Here in one plant is complete integration of a variety of processes involved in turning out the Turboglide transmission—die-casting, forging, machining, forming, and welding.

EDGAR ALTHOLZ, Associate Editor

ing safety door in front of the dies. Once the door is shut, the dies close, molten aluminum is shot in, the dies open, a case is ejected, and the door slides back.

Dies for the job were supplied by the Atols Tool & Mold Corporation, Chicago. The movable (ejector) half weighs 10 1/2 tons, and the stationary (cover) half, 9 1/2 tons. Water in continuous circulation in the dies keeps their temperature between 500 and 550 degrees F.

Since there are a number of machines busy die-casting various aluminum parts, the die-casting area is equipped with a central melting system of three furnaces. One of these is reserved for virgin aluminum. The other two are charged with both virgin and scrap aluminum. For the transmission case only virgin aluminum is used.

Buckets supported from a tramrail carry the molten metal to Ajax holding units at the side of each die-casting machine. These units are induction-heated and maintain the metal at 1275 degrees F. Among other features of the aluminum foundry are a central pumping system which supplies the hydraulic fluid (water and soluble oil) for powering the die-casting machines, and an underground conveyor system which collects the scrap from the trimming presses and returns it to the furnaces for remelting.

In the machining area, the transmission cases are processed on two duplicate transfer lines. Because of the case configuration, pallets are used. Each case is secured to a pallet at the start of the line, then is removed from this pallet at the end of the line.

A qualifying operation, lower view on page 180, prepares the cases for the pallets. Here the cases travel around a W. F. & John Barnes five-station dial type machine. One station is for loading and unloading. At the other stations four locating holes are drilled and reamed, and four locating pads are milled. At one of the work stations there also is an angular head which drills an oil-hole.

Five identical work-fixtures are borne on the dial. The case bore engages three expanding pins on the fixture horn, with the housing bell end supported by equalizing pins in dowel holes in the casting. Front and rear lugs are supported on jacks. Electrically controlled air clamps are actuated automatically as each fixture indexes away from, or to, the loading-unloading station. Cycling is continuous with one case completed for each indexing of the dial. Unloaded, the case is then hooked onto either one of two monorail conveyors, there being a separate conveyor to each transfer line.

Rectangular Transfer Lines

The lines, also built by W. F. & John Barnes, have forty-five stations apiece. The majority of these are work stations, where horizontal and vertical self-contained units perform a variety of operations—milling, drilling, chamfering, and tapping. Other stations involve loading-unloading, changing the flow direction of the pallets, probing for and replacing broken taps, and pressure-testing the case.

Actually each line is a rectangle. Near one corner the work is loaded on a pallet which then progresses over a long side of the rectangle. When the pallet reaches the end of this side, a flow-

direction changing station causes the pallet to progress along a short side of the rectangle. This procedure continues until the pallet returns to the initial station, where the completed case is unloaded.

A close-up view of a loading-unloading corner is shown in Fig. 2. Movement around the rectangle is counterclockwise. Cases on the two pallets in the foreground have been completed. The operator, standing at the loading-unloading station, has already unloaded the preceding pallet and is using a clamping press to secure a new transmission case in place. This work-piece has just been unhooked from the monorail conveyor (not visible) behind the operator, after having completed the qualifying operation.

There are certain advantages in this rectangular layout of the transfer equipment. Since the pallets change their direction 90 degrees at each corner, both sides and both ends of the transmission case are able to front work-stations during some part of the cycle. Also, the rectangle conserves floor area and permits pallet loading and unloading to be combined in one station.

Indexing of the pallets along the side of the rectangle is performed by engagement to horizontal bars. The cylinder powering the bar for the first side in the cycle can be seen in the left-hand foreground of the illustration. All pallets index simultaneously, move the same distance, and therefore, all work-stations are spaced an equal distance apart.

Certain surfaces are rough-milled or rough-bored on the first long side of the rectangle, then finished on the opposite side. Since operating time at the finishing stations is about twice that at the roughing stations, there are actually two identical finishing lines on the second long side of the rectangle. As the pallets approach this side, they are automatically diverted to one line or the other, then after finishing, again converge into a single line. By this means cycle time for the faster roughing stations is able to be maintained.

One of the more unusual work-stations, illustrated in Fig. 3, is the finish-planetary-milling of the large motor-mount face. The cutting tool is a 5-inch shell end-mill. Supported from a geared head, the tool sweeps around in an arc as it revolves.

Drilling Machines Built at an Incline

The input shaft of the Turboglide transmission is made from steel bar. In the first operation the stock is turned, necked, chamfered, and cut off to 16-inch lengths on a four-high Conomatic machine. Then an oil-hole is drilled automatically through one end. Two of the eight Leland-Gifford machines set up for this job appear in Fig. 4. They are grouped in two opposing banks of four machines each and are served by a single operator.

Fig. 1. Biggest component in the transmission is a 14-pound aluminum case here being removed from the die-casting machine.

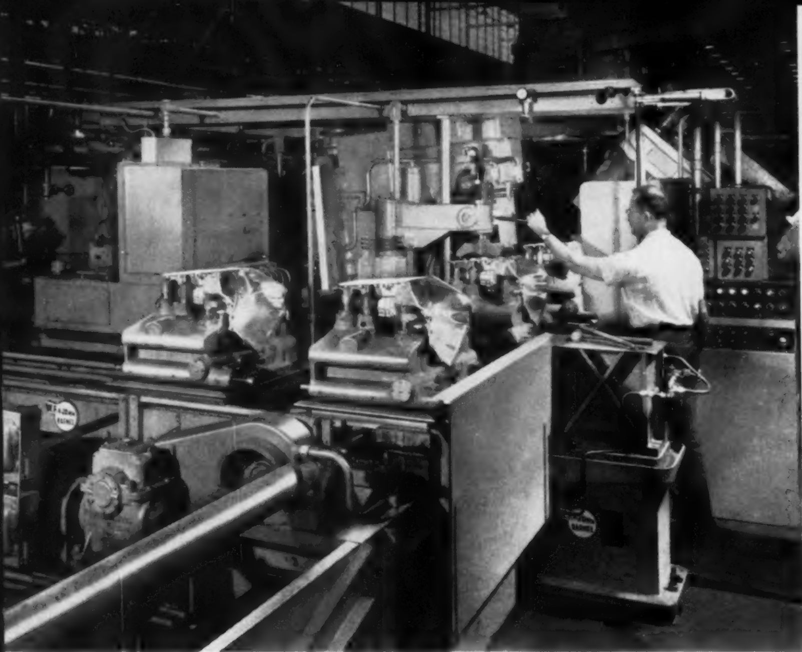


Fig. 2. The rectangular layout of the line permits the two ends and two sides of the case to front work-stations during some part of the machining cycle.

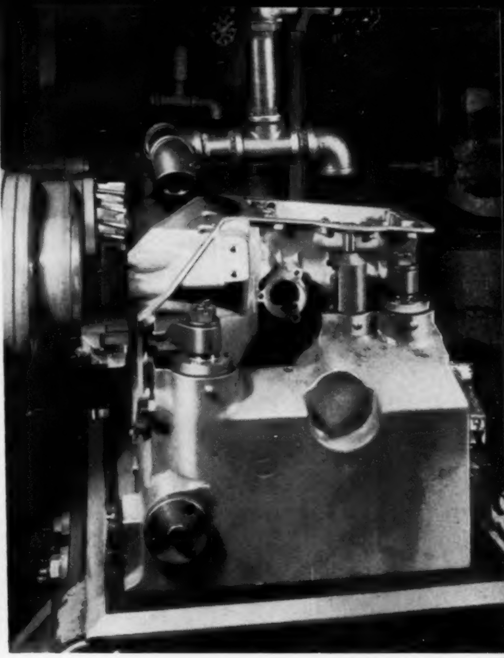


Fig. 3. At this planetary milling station a small milling cutter can cover entire motor-mount face.

The columns of the machines are inclined, permitting a gravity feed and discharge of the work. Stacking fixtures, also inclined, hold eight shafts apiece. In the top of the fixture in line with the lowermost shaft is a bushing through which the drill operates.

The high-helix drills are 3/16 inch in diameter. The hole is about 5 1/2 inches deep, so the spindles retract several times during the stroke to clear the chips. As each shaft drops to lowermost position in the fixture, it is clamped mechanically.

Spindle feed is hydraulic. When final depth has been reached, the spindle retracts and actuates a micro switch which causes the clamp to release, and the shaft is ejected onto the belt conveyor seen in the foreground. This belt leads to another station, where a 1/8-inch hole is drilled in the wall of the shaft at the bottom of the deep hole.

These shafts undergo heat-treating and grinding, then splines are cut on both ends. Four Fellows horizontal, double-end gear shapers—the first of this type—carry out this operation.

One of the shapers appears in Fig. 5. Work loading and unloading, and cutter and work movements are performed automatically. Incoming shafts are stacked in a chute on the left side of the machine. In loading, the shaft lowermost in the chute is pushed into the collet of a centrally located chucking spindle. The collet grips the central portion of the shaft, leaving the work surfaces at both ends exposed.

In the same horizontal plane of the chucking spindle and slightly behind it are two opposed cutter-spindles, one at each end of the machine. Once a shaft is in position, the chucking spindle rotates and the cutter-spindles reciprocate and rotate. In approximately one minute the sixteen teeth of each spline are completed, and the shaft is ejected into the discharge chute seen in the foreground.

Each shaper has an integral hydraulic system, visible under the left-hand cutter-spindle. This system powers the reciprocating movements of the cutter-spindles and the indexing of the work into and out of the chucking spindle.

Transfer Equipment Pallets Have Unusual Function

Outside of the input shaft, made from bar stock, the three other shafts in the transmission originate as cold-drawn, seamless-steel tubing. One of these (the T-2 shaft) is upset at one end, then goes through a series of machining operations and is seam-welded to a pressed steel drum to form the turbine shaft and front gear-ring hub assembly.

Machining following the welding includes two slotting operations on the drum section. These slots are milled on the Kent-Owens transfer equipment shown in Fig. 6. At six equally spaced points around the drum periphery, closed slots are milled; and at four other equally spaced points, open slots are milled. The work stations

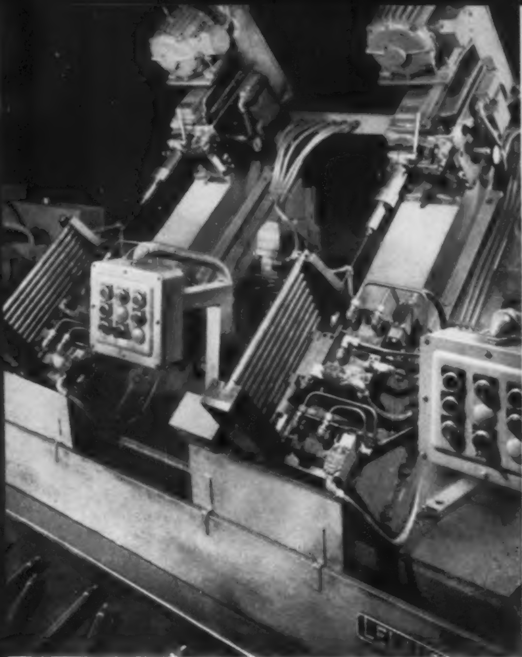


Fig. 4. These drilling machines take advantage of gravity for automatic loading and discharge.

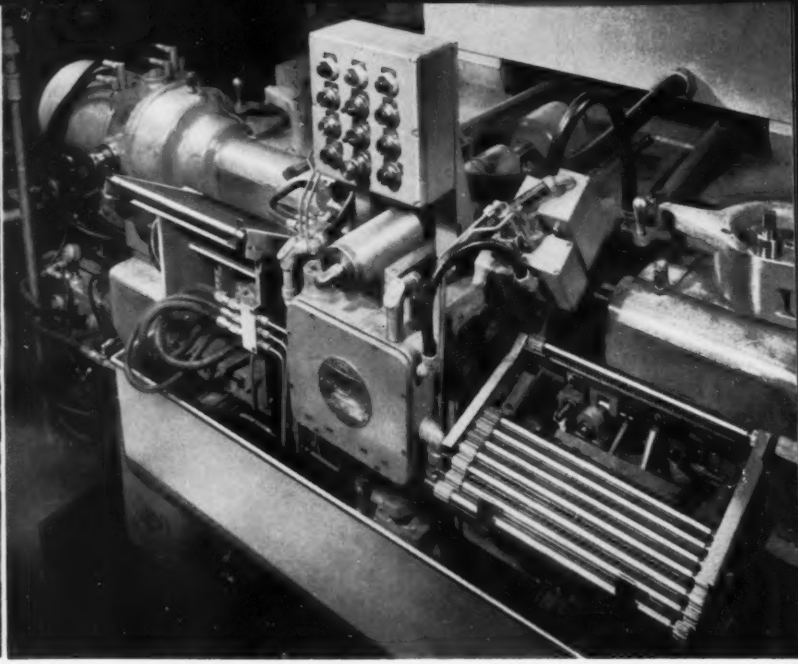


Fig. 5. In this unusual machine design the work is gripped centrally and the two opposed cutter-spindles reciprocate horizontally at the same time.

consist of two rise-and-fall milling machines. Three assemblies are processed together, there being three cutters mounted on the arbor of each machine.

Work progression from station to station is unusual. There are three hydraulically operated pallets, each carrying a row of three work-fixtures. These fixtures grip the drum section of the assemblies. The first milling machine, a standard horizontal model, completes the six closed slots; and the second machine, equipped with a hydraulic head feed, completes the four open slots.

As the work goes through the line, it transfers from one pallet to the next. In the illustration, the operator, seen at the loading station, has placed new assemblies in the fixtures on the pallet in front of him and is about to start a cycle. At this moment, the slotting operations initiated in the previous two cycles have been completed, and the assemblies have been returned to pallets at the two work-stations.

When the next cycle starts, the pallets at the work-stations retract and move to the left until the pallet leaving the second station is in front of an unloading station (not visible), and the pallet leaving the first work-station is in front of the second work-station. At the same time the pallet at the loading station moves to the left until it is in front of the first work-station and turns 90 degrees counterclockwise. All three pallets then advance: the pallet at the unloading station ejects its assemblies, and the pallets at the two work-stations move up until the shaft sections of the assemblies are gripped in the collets of indexing fixtures beneath the milling spindles, then retract slightly.

Next, the pallets reverse their movements and return to their original positions, as illustrated. Milling follows. One slot at a time is cut in each drum, with the fixtures at the first work-station indexing 60 degrees for the closed slots and the fixtures at the second work-station indexing 90 degrees for the open slots.

When all slots have been milled, the spindles stop rotating and the indexing fixtures release their grip on the shaft section of the assemblies. Then the pallets at the two work-stations advance, and the pallet fixtures retrieve the assemblies, gripping them on the drum section.

Automation Reaches High Point in Gear Making

Manufacture of small planetary gears for the Turboglide transmission, required in large quantities, is expedited by elaborate material-handling and inspection means from operation to operation. The processing sequence consists of cutting off the gear blanks from bar stock, washing, face-grinding, face-honing, boring, hobbing, shaving, heat-treating, tooth-chamfering, bore-honing, tooth-honing, and sound-testing. There are sixty separate machine tools involved.

Tying all the machines together is an intricate network of Lamb conveyors, chutes, storage units, line switches and shot-bolt assemblies

which eliminate all manual material handling except for the placing of the gears in baskets for the heat-treating. At many points in the processing, automatic inspection has been integrated. Some of the machines have automatic feedback correction.

One of the hobbing stations in the planetary gear line appears in Fig. 7. Blanks roll down a chute and advance to a loading station, as needed. The hobbing cycle consists of generating fifteen helical teeth of 20-diametral pitch. Automatically discharged down another chute, the gears roll into an elevator and are raised to a conveyor which distributes them to the battery of gear shavers. Prior to their discharge the hobbed gears pass through an inspection station. The machine, a Lees-Bradner vertical single-spindle model, has a feedback mechanism for adjusting the hob setting.

Also visible in the illustration, to the left of the hobbing machine, is an inspection station. This unit accepts or rejects parts and signals the machine to adjust for size variation.

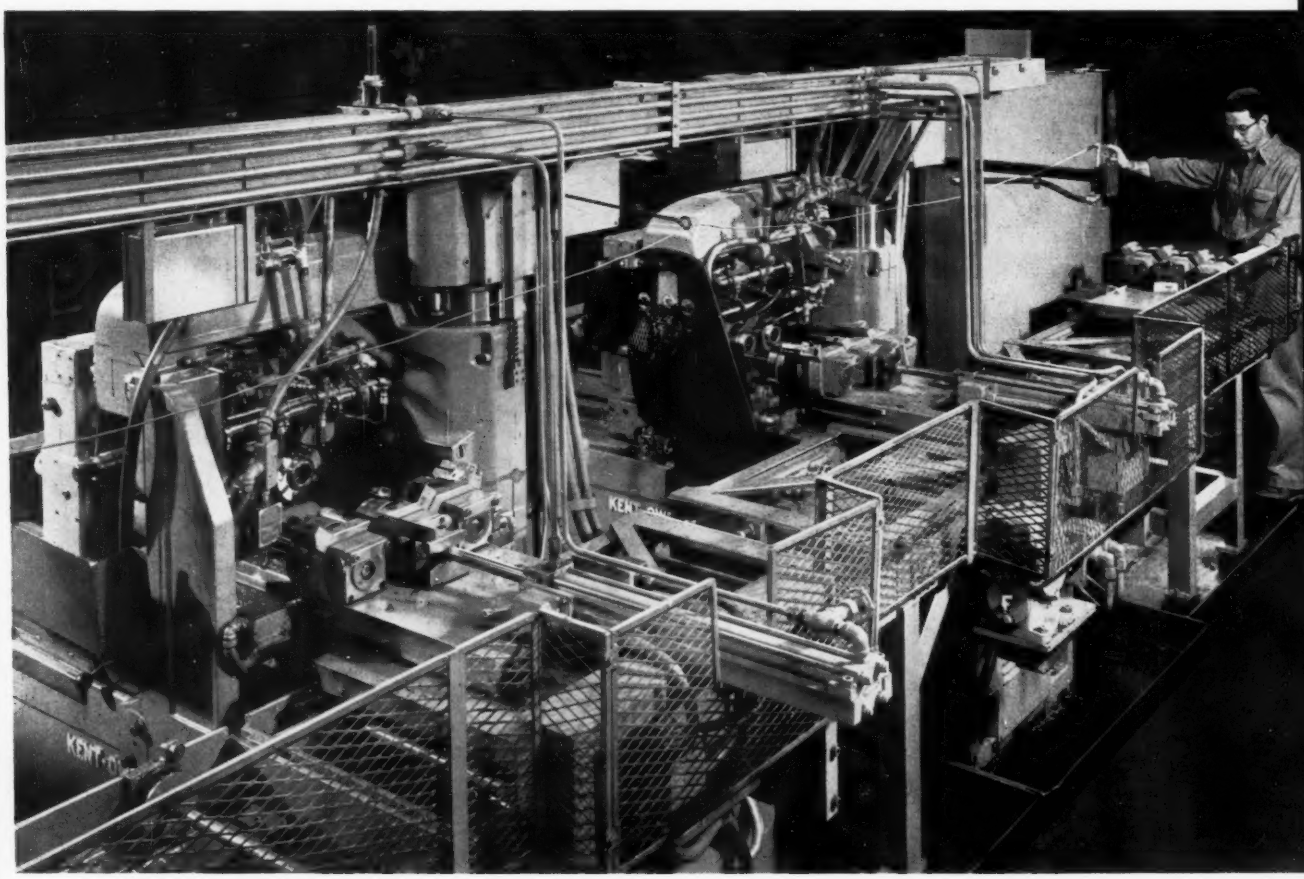
Equipment Combines Machining and Assembling

Heart of the Turboglide's unique variable-pitch stator is a ring arrangement of twenty small magnesium blades. Pitch is varied through the movement of a steel crank which is pressed into the body of each blade. A high degree of automatic manufacture is performed by a battery of Agnew machines which completely process the blades from lengths of extruded bar stock, then locate and press in the cranks.

A close-up view of one of the machines appears in Fig. 8. Several blade-crank assemblies can be seen on the machine apron in the foreground. Extrusions having the cross-section of the blade are fed in 20-foot lengths into the left-hand side of the machine. When the bar abuts a stop, jaws clamp the end and at the same time twist the thin edge to a required helix.

While the bar is clamped, a carbide circular saw cuts off a blade. If the saw becomes broken, an air gage stops the cycle automatically. Next

Fig. 6. The work-pieces change pallets three times in cycling through this transfer equipment. Progression from loading station to work and unloading stations is entirely automatic.



a gun drill enters from the right-hand end of the machine and produces the hole for the crank. The blade, once severed, is pulled up between two stationary broaches which straddle the ends to establish proper length. One of the broaches leaves a square end, and the other, a curved end.

The blade has now reached a pressing station and is ready for assembly with a crank. The cranks have been formed on a four-slide wire machine and then heat-treated. They flow down a chute from the hopper seen on the right-hand side of the Agnew. A mechanism aligns each crank with the hole in the blade body and gives the throw of the crank correct radial position. A punch then forces the crank into the hole. (To assure a tight assembly, the periphery of the crank is serrated in the wire-forming operation.) The assembly, now complete, is ejected from the machine by air.

Largest piece of metal-forming equipment at Chevrolet-Toledo is a Verson 3000-ton Transmat press. Torque converter covers and oil pans are turned out on this press. Both parts go through a series of progressive forming and piercing operations, automatically and at high speed.

The major part of the torque-converter setup can be seen in Fig. 9. There are two slides and bolsters, separated by center columns in front and back. In the area between the columns is a turnover device. Work progresses through a series of stations grouped in the first slide, is turned over as it passes between the center columns, then progresses through a series of stations in the second slide. In the illustration the eight stations of the first slide and the turn-over station are visible.

Developed blanks for the cover are 14 1/2-inch diameter steel discs, 0.224 inch thick. Fed into the right-hand side of the press, the blanks are advanced from station to station by mechanical fingers which operate in time with the up stroke of the slide. The dies at the various stations of the first slide draw the body to a hat shape, then reduce the size of the hat, developing the body contour and center, and finally form the flange. After the cover is turned over, the dies of the second slide restrike the flange and pierce a hole circle in the flange.

The plant's forging area, too, reflects the stress placed on manufacturing efficiency. Presses and upsetters are set up to minimize work handling.

In Fig. 10, a planet gear spacer is being forged on a 1300-ton National Maxipress. Slugs in the

Fig. 7. One of twenty machines which hob the planetary gears. Each machine receives blanks from preceding operations through the Lamb network.

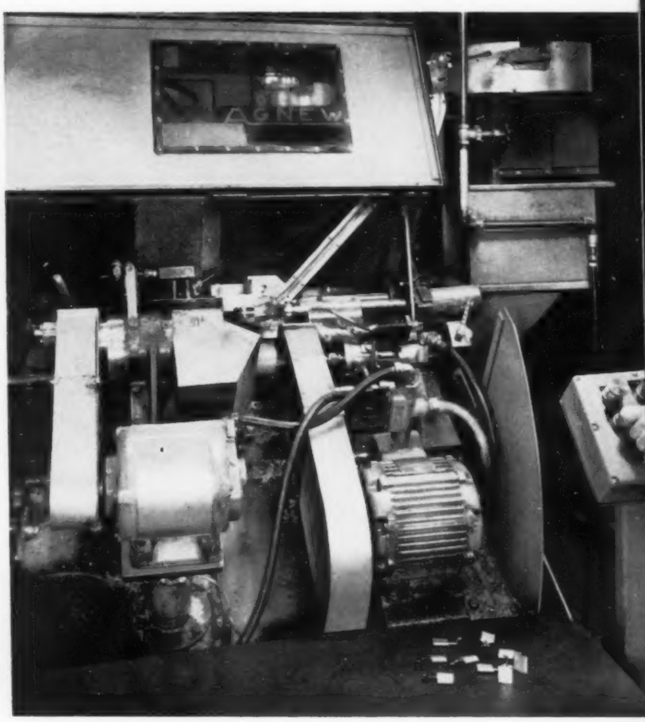


Fig. 8. The blade is twisted, drilled, cut off, and broached; then the crank is pressed in and the assembly is ejected—all automatically.

Fig. 9. (Right) Because sequential operations are performed without interruption, the work has no time to age-harden and does not require annealing.

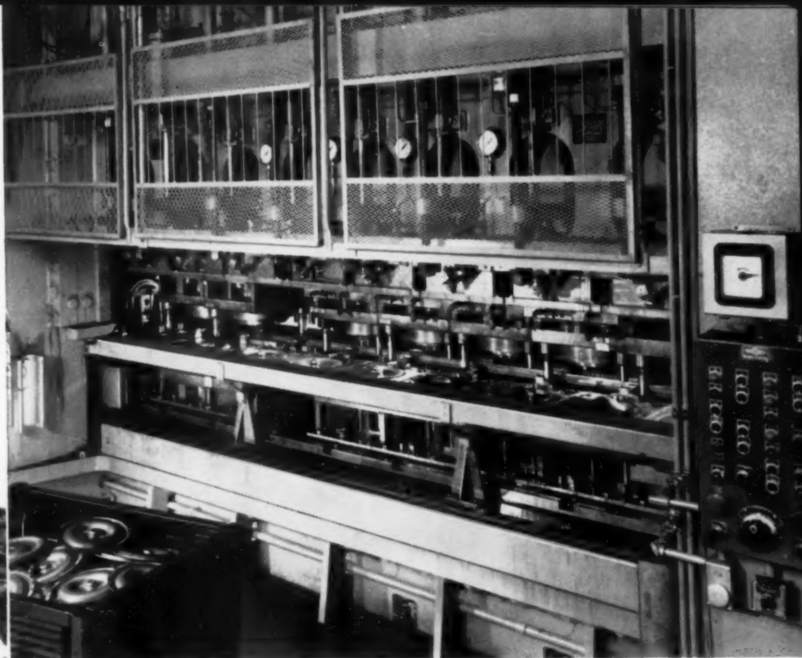


Fig. 10. (Left) Besides being rapid, induction-heating the slug brings "good housekeeping" to the forge area.

bin in the foreground travel up a KDI elevator, flowing into a chute leading to a Tocco induction unit. With a minimum of motion the operator removes the slug, after it is rapidly brought to forging temperature, and places it in the right-hand die for the blocker impression. For the second impression the work is placed in the left-hand die, and then in the center die for the final impression. Finished forgings roll down a chute in the rear leading to a trimming press.

The plant's laboratory keeps a continual check on the performance of the Turboglide. In the upper view on page 180, for example, technicians test a transmission coupled through an engine block section to a dynamometer. (The axle end of the transmission is coupled to an absorber.)

Durability is tested by establishing full engine torque. In testing the efficiency of the converter, the input torque is held constant while the output speed is varied.

JOHN NIEMINEN
Chief Mechanical-Handling Engineer
Ohio Stamping Plant
Chrysler Corporation

CHRYSLER

Automates New Stamping Plant

THE FORWARD LOOK in Twinsburg, Ohio, connotes one big press hit after another.

Here, midway between Cleveland and Akron, the Chrysler Corporation's new stamping plant is rapidly approaching full production. An investment of close to $85,000,000, the 1,740,000-square-foot structure is the company's third manufacturing location in the Buckeye State.

Twenty-eight major press lines totaling 260 presses, many of which are already running, will feed approximately 300 different body stampings to assembly plants in Michigan, Indiana, California, and Delaware. Five weigh 600 tons each, with a stamping force of 1800 tons. The majority weigh 300 to 400 tons and operate at ten to thirty hits per minute.

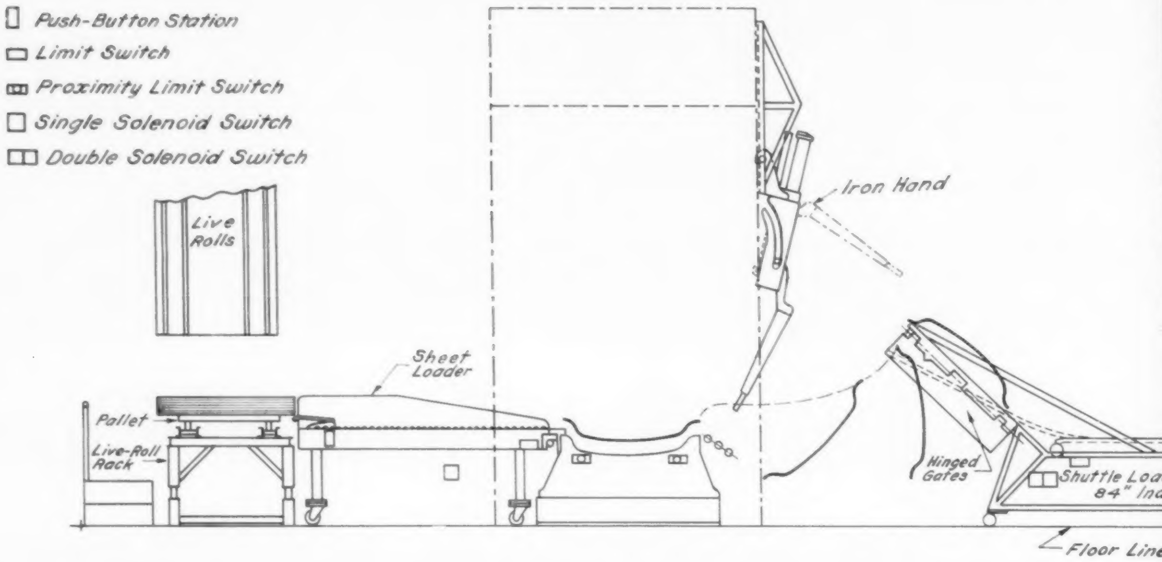
The latest and most advanced mechanical-handling techniques are used to move parts from press to press. Similarly, in preparing the steel for the presses and later in welding operations, well-developed automated equipment is at work. The die shop—a story in itself because of its unusual array of machine tools—makes the plant a completely self-contained unit.

One of the first major press lines to be put in operation, Line 28, turns out Plymouth roof panels. Steel for the panels enters the plant as flat sheet 72 inches wide, 89 inches long, and 0.039 inch thick. As a first step, the sheet goes through a McKay Flex-Roll processing machine. This equipment stress-relieves the sheet by flexing it in a wavy path through a series of rolls. All "show" panels on car bodies undergo such treatment before drawing, to eliminate stretcher strains and fractures in the finished stampings.

Transported to Line 28, the sheets are stacked on a live-roll table in front of the first press, Fig. 1. The stacks are delivered on pallets, which are carried by rolls to the operator's station. There each sheet is placed in a loader which shuttles it forward into the die. This Danly 1000-ton press, of triple-action underdrive design, draws the sheet to its first shape.

In Fig. 2 is a flow chart of the work through

Fig. 1. Roof panel sheets are positioned in the loader of the drawing press. The work is moved with mechanical-handling equipment until it leaves the press line.



the three presses of the line. The sheet, drawn upside down, is lifted up in the die by air cylinders. Then, as shown in the heading illustration, a Sahlin air-operated Iron Hand on the back of the press reaches in to extract the panel. A limit switch on the extractor jaw provides a safety interlock; when a panel is being extracted, it breaks the press-run circuit, preventing the press from recycling.

As can be seen in the flow chart, the extractor pulls the roof panel onto a flip-over device, built by the G. & W. Automation Co., Detroit. The device inverts the panel so that it now travels right side up.

A shuttle loader moves the panel into the second press for restriking. This is a Danly 1000-ton single-action underdrive press. Air cylinders lift the panel from the restriking die and another Iron Hand extracts the panel to a second shuttle loader, Fig. 3. In the third press, a duplicate of the second, the excess stock is trimmed off. Side-arm extractors, seen in Fig. 4, move the completed panels onto a belt conveyor. Leaving the conveyor, the panels are inspected and stacked,

Fig. 3. The Iron Hand extracts the panel from the restriking die in the second press, after air cylinders within the die have operated.

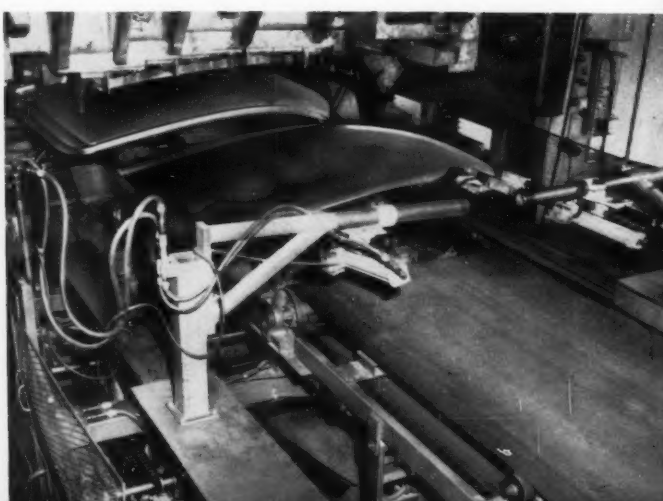
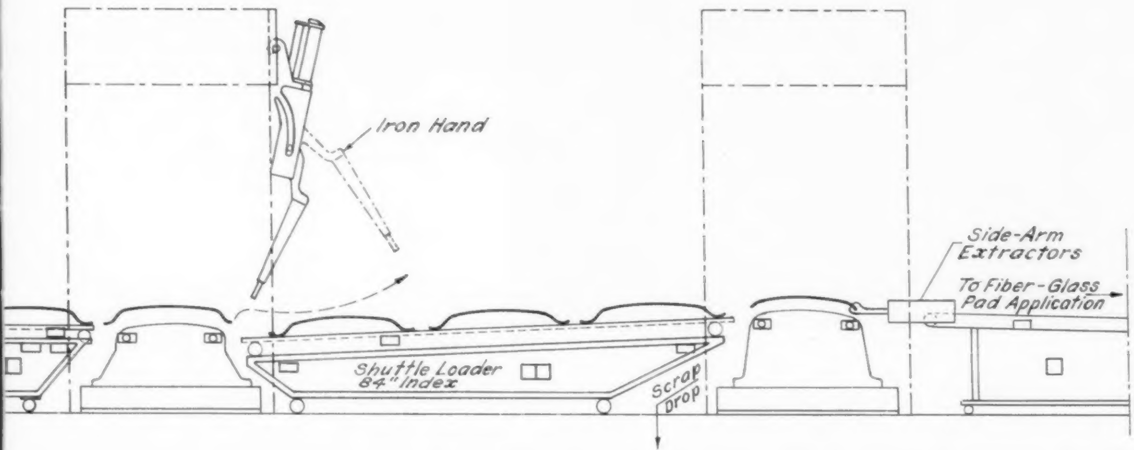


Fig. 4. After trimming, the last of the press operations, panels are pulled onto a belt conveyor by side-arm extractors.

Fig. 2. This flow chart shows the progression of the roof panel through the three presses of the line for drawing, restriking, and trimming.

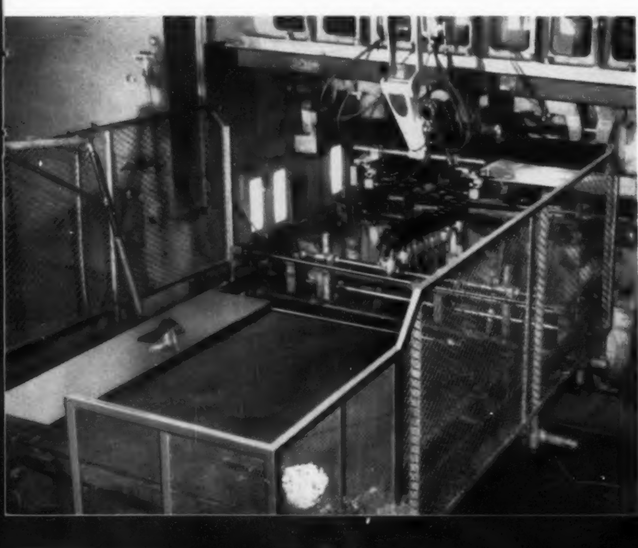


and are ready for the next operation—the application of a fiber-glass pad to the underside.

On Line 23 are some material-handling devices of unusual interest. Figs. 5 and 6 show two of them. This line turns out the Plymouth right-hand rear quarter panel.

The quarter panel is obtained from 0.042-inch steel coil. After being blanked to a parallelogram shape, it enters the line for the drawing operation. Drawing is performed upside down, and the sheet is loaded into the press long-edge forward. Down the rest of the line, however, the sheet is handled right side up and short-edge forward. The view of the back of the drawing press, Fig. 5, shows the mechanical handling devices. A dual-jaw Iron Hand extracts the panel from the die, depositing it in a positioning fixture. The panel is first turned over, then rotated 90 degrees, and advanced to the next press for rough trimming.

Fig. 5. Handling devices flip the quarter panel over, then rotate it 90 degrees so that it moves down the line short-edge forward.



The other view, Fig. 6, shows how the panel is extracted from a die by means of vacuum cups. A horizontally moving bar carrying two vacuum cups lifts the panels from the die onto a belt conveyor. Since all excess metal has been removed, the cups do the job without marring the panel.

Except for very large parts like hood panels and roof panels, steel comes into the stamping plant in coil form, then is blanked to a particular size for the drawing presses. A flow chart for one of the seven McKay decoiling lines which feeds a blanking press appears in Fig. 7.

Coils are brought in on a motor-driven rail car and supported horizontally in a holder. As the material unwinds, it passes through a processing unit where it is cleaned thoroughly by brush rolls and high-volume sprays of solvent. The solvent also serves as a die lubricant, by leaving a film of oil on the strip. Cleaning is done before the strip passes through any of the sets of opposed flexing rolls in the line, so that dirt and slivers are removed before they have a chance to damage the surface of the material.

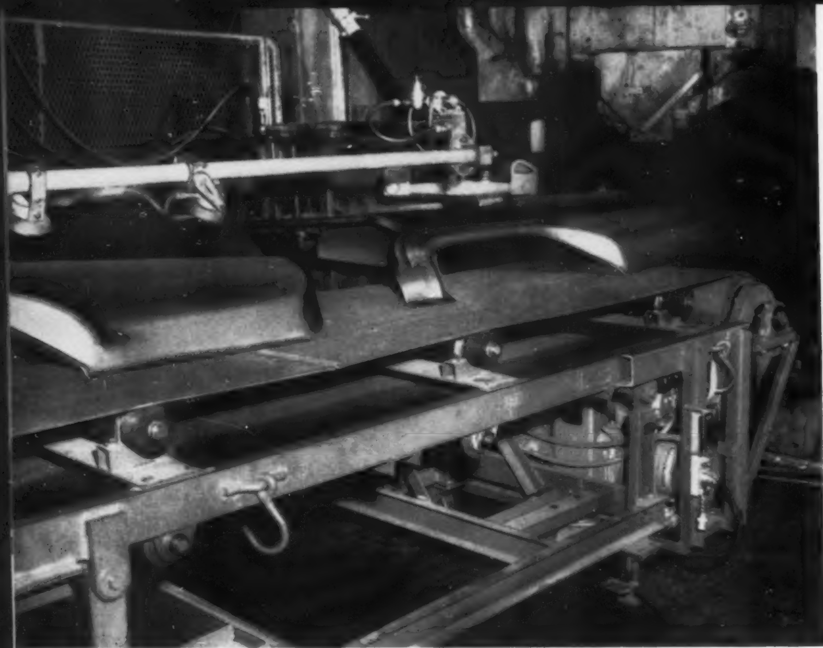


Fig. 6. The bar carrying the suction cups moves horizontally, extracting the panels from the press and depositing them on the conveyor without marring the surface.

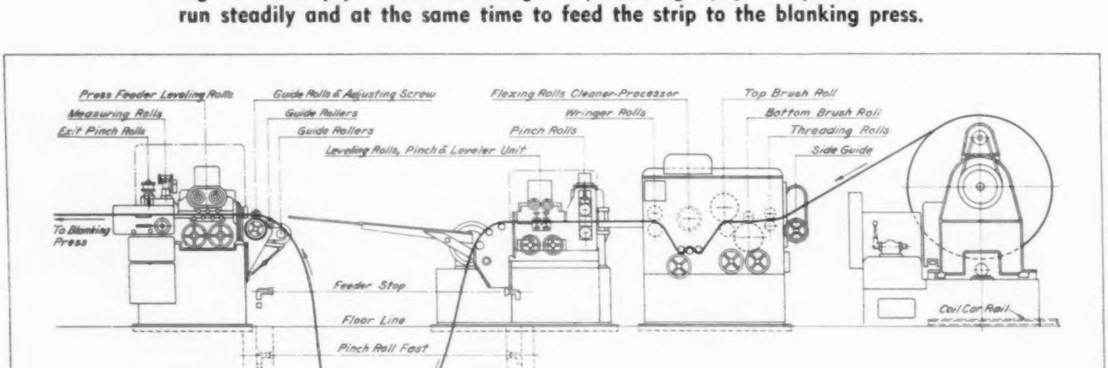
The material is flexed, as previously described for the roof-panel sheet, passes through wringer rolls, and then enters a leveling and pinch-roll unit. In addition to straightening the strip after it has been flexed, the rolls in this unit, which are motor-driven, do the actual decoiling and pull the strip through all previous rolls.

Next, the strip falls into a loop in a storage pit, from which it is picked up by the press feeder unit. This loop is needed, since it is desirable to decoil steadily, yet it is necessary to feed the press only intermittently. Electric sensing devices in the form of different tiers of photo-electric cells in the walls of the pit maintain the loop in a specified length range by regulating the decoiling equipment as required. This line runs at about 200 feet per minute.

In Fig. 8 is a view of the blanking press fed by this decoiling line. Feed is through the press sides, from right to left. (Other lines have a front-to-back feed.) Here, Plymouth cowl tops are blanked, two per hit. These particular blanks are discharged through the left side of the press, but on some other parts the blanks are discharged from both the left side and the front of the press. At both unloading points are Wean stackers and transfer cars.

The welding of stampings to form assemblies keeps pace with production along the press lines. One automated welding installation appears in

Fig. 7. The loop pit in this decoiling and processing equipment permits it to run steadily and at the same time to feed the strip to the blanking press.



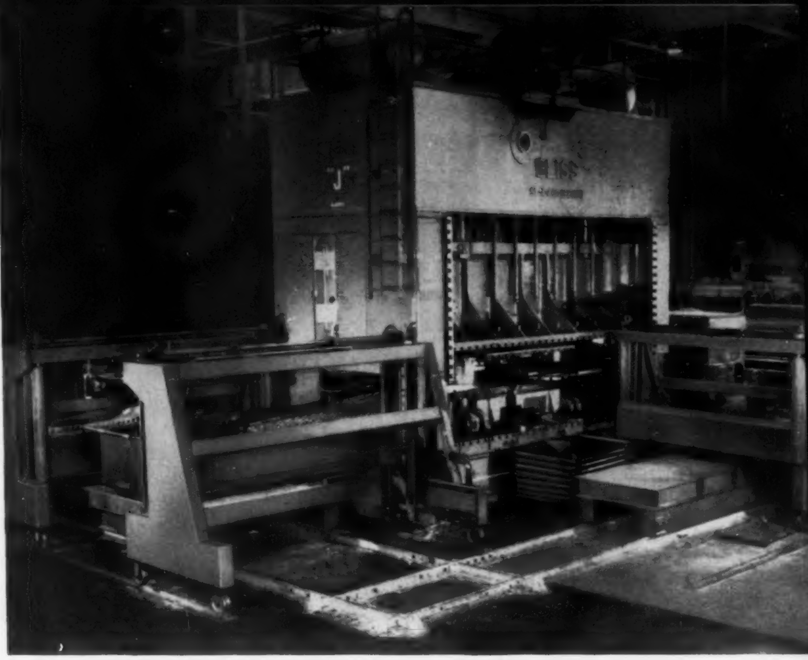


Fig. 8. Strip from the feeder unit (seen in Fig. 7) comes in through the right-hand side of the press. Discharged blanks enter stackers and transfer cars.

Fig. 9. The view shows the first unit of a four-press welding installation for the Plymouth rear floor-pan assembly.

Pan stampings move up a belt conveyor to the first unit. This is a "marriage" station, the pans being spot-welded to side-panel sub-assemblies which enter the station from an auxiliary welding line, seen on the left. The pans automatically shuttle through the other three presses, receiving the fuel tank underbody reinforcement at the second press, the fuel tank filler tube retainer at the third press, and the spare wheel anchor-rod bracket at the fourth press.

Components welded at the second and third presses are loaded automatically. Transformers, guns, fixtures, and mechanical handling devices were built by the Delta Welder Corporation, Detroit, Mich.

Fig. 9. Floor pans on their way up a belt conveyor to four welding presses, where they will meet components to form assemblies.

Machine Tool Builders Face the Future with Confidence

AT THE fifty-sixth annual meeting of the National Machine Tool Builders' Association held at French Lick, Ind., October 23-25, Jerome A. Raterman, president of the Association, and chairman of the board and president of the Monarch Machine Tool Co., pointed out that the volume of sales by Association members would be about $516,000,000 this year. While that figure is considerably less than the industry has become accustomed to, Mr. Raterman pointed out that during the peacetime years from 1946 to 1950, inclusive, and in 1955 and 1956 production in the industry averaged only $434,000,000 annually.

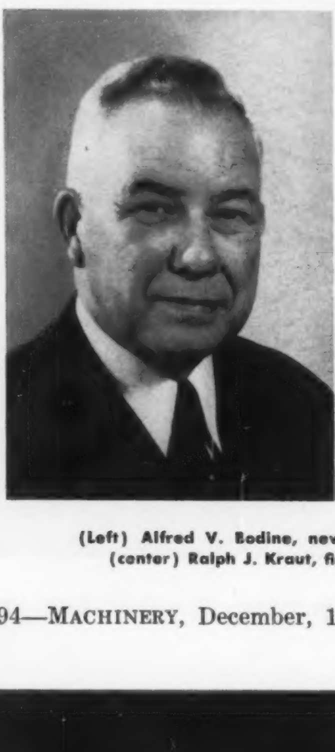
Three reasons were cited for looking toward the immediate future with confidence: (1) figures on age and obsolescence of machine tools now on plant floors indicate an enormous potential replacement market; (2) beyond this market lies future demand for machine tools for plant expansion projects delayed, but not abandoned; and (3) rate of research and product development within the machine tool industry.

Mr. Raterman decried the lack of understanding on the part of business analysts and financial commentators with regard to the business of the machine tool industry. He stressed the fact that while the industry has had great variations in volume due chiefly to defense emergencies, the record of earnings and dividends is one of remarkable stability. He pointed out that there is enough potential business in replacement alone to put sales on an ascending scale—aside from sales for defense, export, or plant expansion.

Over 300 executives of machine tool companies attended the first meeting. The concerns they represented account for 90 per cent of the country's machine tool capacity.

One of the high points of the meeting was a panel session in which the advantages and disadvantages of selling direct and through distributors were considered. The moderator of the panel was Frederick S. Blackall, Jr., president and treasurer of the Taft-Peirce Mfg. Co. Participants on the panel were Kenneth M. Allen, executive vice-president of the Rockford Machine Tool Co.; Walter K. Bailey, president of the Warner & Swasey Co.; Frank U. Hayes, vice-president and assistant general manager of the Bullard Co.; and Ralph J. Kraut, president of the Giddings & Lewis Machine Tool Co.

Dexter M. Keezer, vice-president of the McGraw-Hill Publishing Co. and director of its department of economics, stated that American industry will spend more money for research and development in 1958 than in any year of its history. The expenditure this year will be over



(Left) Alfred V. Bodine, newly elected president of the National Machine Tool Builders' Association; (center) Ralph J. Kraut, first vice-president; and (right) Alan C. Mattison, second vice-president



(Left) Graham E. Marx, treasurer of the Association; (center) Walter K. Bailey, secretary; and (right) Julian C. Pease, one of the new directors

$7,000,000,000, and it will be considerably higher next year. Mr. Keezer said that the flood of new products, new processes, and equipment that will result from this tremendous volume of research and development indicates that any dip in investments for new production facilities will be relatively brief. He stated also that the availability of ample capacity for producing almost everything will be a key contributor in making 1958 the most competitive year for American industry since the end of World War II. He predicted that alert company managements will be more eager than ever to purchase cost-cutting equipment.

In reporting the activities of the government relations committee, Swan E. Bergstrom, chairman of the committee and executive vice-president of the Cincinnati Milling Machine Co., told about recommendations that had been made to the Treasury Department concerning depreciation of machine tools. He stated that the recommendations had been well received and if adopted would go a long way toward eliminating inequities that exist in the present Bulletin F. Mr. Bergstrom reported that the Office of Defense Mobilization has now set up a policy in regard to the rental of government-owned machine tools and facilities. This should be a big help in resolving the question of rental of government machine tools to other than defense manufacturers and should give better control of the government-owned facilities than was possible in the past. A bill is being prepared which, if passed, will arrange for the application of the proceeds from machine tool rentals to the replacement of obsolete equipment. The Services feel that a sound replacement policy should be set up.

Arvid O. Lundell, recently appointed advisor to the Metalworking Equipment Division of the Business & Defense Services Administration and president of the Colonial Broach & Machine Co., made a short speech in which he mentioned that he is planning to send out a monthly letter that will discuss machine tool activities in Washington. He was followed by Niels A. Olsen, acting director of the Metalworking Equipment Division, who discussed the current programs and problems of the Division. William Andrew Paton, professor of accounting, University of Michigan, presented a paper entitled "Measurement of Cost under Inflation Conditions." Rowell A. McClenaghan, chairman of the committee on advertising and market research and advertising manager of the Barber-Colman Co., presented a number of awards to advertising managers and agencies for excellence in their profession.

Alfred V. Bodine, president and treasurer of the Bodine Corporation, Bridgeport, Conn., was elected president of the Association for the coming year. Ralph J. Kraut, president of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., was elected first vice-president; Alan C. Mattison, president of the Mattison Machine Works, Rockford, Ill., was elected second vice-president; Graham E. Marx, vice-president and general manager of the G. A. Gray Co., Cincinnati, Ohio, was elected treasurer; and Walter K. Bailey, president of the Warner & Swasey Co., Cleveland, Ohio, was re-elected secretary. New directors elected were Messrs. Mattison, Marx, and Julian C. Pease, executive vice-president of the New Britain Machine Co., New Britain, Conn.

Successful Production of Man-Made Diamonds

Man-made industrial diamonds, identical and equal in performance to those made by nature, will be produced in substantial quantities by the Metallurgical Products Department of General Electric Co., Detroit, Mich. More than 100,000 carats of the man-made diamonds already have been produced in pilot-plant operations.

Successful pilot-plant production follows by only slightly more than two years the G-E announcement that a reproducible process had been discovered for making diamonds in the laboratory. This advancement was expected to take five to ten years and represents an investment of 2 1/2 million dollars by the company.

Some companies have been evaluating the diamonds in the field for months. By the end of this year, a considerable amount—suitable for grinding wheels, lapping compounds, and similar applications—will be in industrial use. Plans have been made to expand production in 1958, thus insuring a domestic source for a strategic material.

It has been estimated that the United States will import 7 million carats of fragmented bort this year for industrial use, and as many as 10 million carats have been used in times of national emergency. With diamonds in plentiful and continuous supply, it has been predicted that American industry could consume the latter amount annually in peacetime. While the present cost of man-made diamonds is about 40 per cent more than natural ones, it is believed that new uses, increased production, and improved processing will make the prices more competitive.

At present, the sizes of man-made diamonds range from those that will pass through a 60 mesh sieve, down through 600 mesh. While these sizes are satisfactory for over two-thirds of existing industrial abrasive applications, methods of making larger diamonds are being sought. Collectively, they look black or gray, but individually they have all the variations of color, clarity, and crystallinity found in natural diamonds. More important, the optical properties, X-ray inspection, chemical examination, and hardness tests show the man-produced diamonds to be identical.

The Government has placed secrecy orders on the patent applications covering the process and apparatus under a wartime law (never rescinded) preventing publication of information which could be helpful to an enemy nation. However, it can be said that presses such as those shown in the accompanying illustration are used, and techniques have been developed for achieving sustained pressures up to 2,400,000 psi at temperatures of 5000 degrees F. The Government is not stockpiling the diamonds.

Industrial applications which offer the greatest immediate potential have been approached first. These include resinoid and vitrified bonded, diamond grinding wheels for the finishing of cemented tungsten-carbide cutting tools. In experimental tests, both a natural and a man-made diamond wheel were used at the same time on the same machine under carefully controlled manufacturing conditions. All tests have shown that the man-made material performs as well as the natural product in these types of applications. Similar work, with favorable results, has been carried out in the areas of lapping compounds and the finishing of natural diamond wire dies.

Men in right foreground are examining man-made industrial diamonds made by the Metallurgical Products Department of General Electric. Machines which must withstand super pressures and temperatures required in producing the diamonds are seen at the left and in the background.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Jig Clamp That Prevents Distortion of Thin Work-Pieces

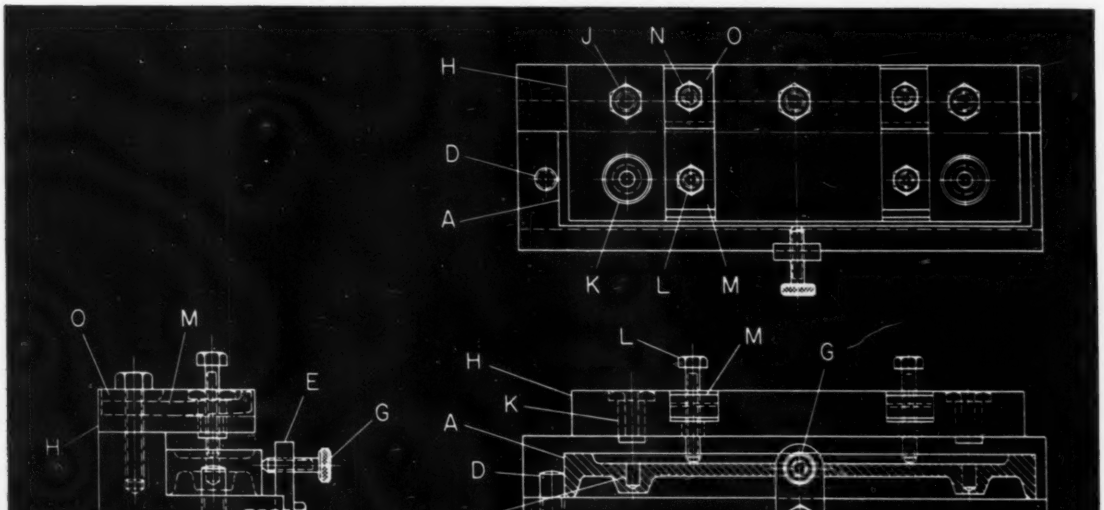
W. M. Halliday, Southport, England

There is danger of deforming, cracking, or bending slender work-pieces made of a soft alloy when clamping is necessary to hold the part during an operation. An unusual drill-jig clamp designed to eliminate distortion is seen in Fig. 1. Once the holding device is pre-set to apply the necessary safe amount of pressure, it is almost impossible for the machine operator to produce deformation in the parts by any further tightening of the clamp. While designed to hold a specific part, the general method may be advantageously applied to a variety of work.

The jig illustrated was made to hold a rectangular aluminum-alloy casting *A*. This part is hollowed out for almost its full length on the top and bottom, thus leaving a thin, weak center web. The under side of this web has bosses at two widely spaced points, one close to each end. Blind holes *B* are drilled into each of the bosses from the upper side of the web. These holes are precisely spaced and perpendicular to the top of the casting. All four edges of the castings are surface-ground before performing the drilling.

Originally, casting *A* was clamped in position by two ordinary set-screws that bore down on the thin web at points close to the bosses. Owing to the softness of the alloy and the thin, weak, unsupported character of the work, it was found that numerous castings were cracked along the web due to the application of excessive holding pressure by the set-screws. With many castings, other errors occurred. These were due to drilling

Drill jig provided with spring clamps that prevent application of excessive pressure on thin work.



holes B while the web was severely bent by clamping. After releasing the set-screws, the web sprang back to, or almost to, its as-cast condition. As a result, the holes were not correctly spaced, not parallel with each other, and not perpendicular with the sides of the casting. To avoid such difficulties, the drill jig was redesigned to employ the method of clamping here illustrated.

In the modified jig, the L-shaped iron casting C is machined all over. It has a broad horizontal base, with the top surface accurately ground to receive work-piece A for drilling. The under side is hollowed out full length to allow the casting to stand firmly on the machine table. A pin D, threaded into the top surface of the jig base, locates the work correctly endwise.

A shallow slot is cut vertically into the middle of the front side of the jig base to receive piece E which is fastened by screw F. Locking screw G presses the work-piece against the machined inner vertical side of the jig base, thus locating the work properly in the crosswise direction.

The top plate H is permanently fixed to the top of the raised portion of the jig base C by screws J. About half the width of the top plate overhangs the raised portion of base C. Two hardened steel drill-guide bushings K are mounted in this projecting portion of the top plate for locating the twist drill.

The casting is held down in position on the flat base by two clamping screws L which are mounted in the following manner within the top plate. Two parallel slots of identical size are machined across the top of plate H at a suitable spacing. The width of each slot is about three times the diameter of the clamping screw and the depth is two-thirds the thickness of the plate.

Fitted loosely within each slot is a hardened and tempered spring-steel clamping strip M whose length is approximately equal to the width of the top plate. The thickness of spring clamps M is somewhat less than the diameter of the clamping screws. Each spring clamp is fastened within its slot by screw N and a short rectangular steel clamping pad O. The latter is a close sliding fit within the slot and is situated on top of the spring clamp. The front under-side edge of each pad is rounded so that the spring strip is free to move upward during clamping. Clamping screws L are threaded to turn easily through a tapped hole in the spring clamps. These screws are located so as to bear down on the thin center web of the casting at approximately the center line of the drill-guide bushings. Clearance holes are provided in the top plate for clamping screws L. These should be of sufficient size to allow the screws to be turned readily by finger pressure even when the clamps have been sprung upwards a considerable amount.

When the jig is not loaded with a casting each spring clamp rests against the bottom of its slot. The spring clamps are tempered to have a degree of resilience. This is determined by the amount of clamping pressure required on the work-piece. By fitting the clamping screws into separate spring clamps instead of into the solid top plate, only a certain gripping pressure can be applied. Further adjustment of these screws merely results in the clamps being sprung upward and does not impart excessive additional pressure.

In this case, when clamping down the work-piece, the operator simply continues to adjust screws L until the spring clamps have been raised enough to bring their top edge level with the upper surface of the top plate. The clamps were made to give the proper holding pressure when in this position.

With the illustrated example, the spring clamps were proportioned and tempered so as to limit the gripping pressure to 7 1/2 pounds on each screw. This clamping pressure may be varied with the size and shape of the work-piece.

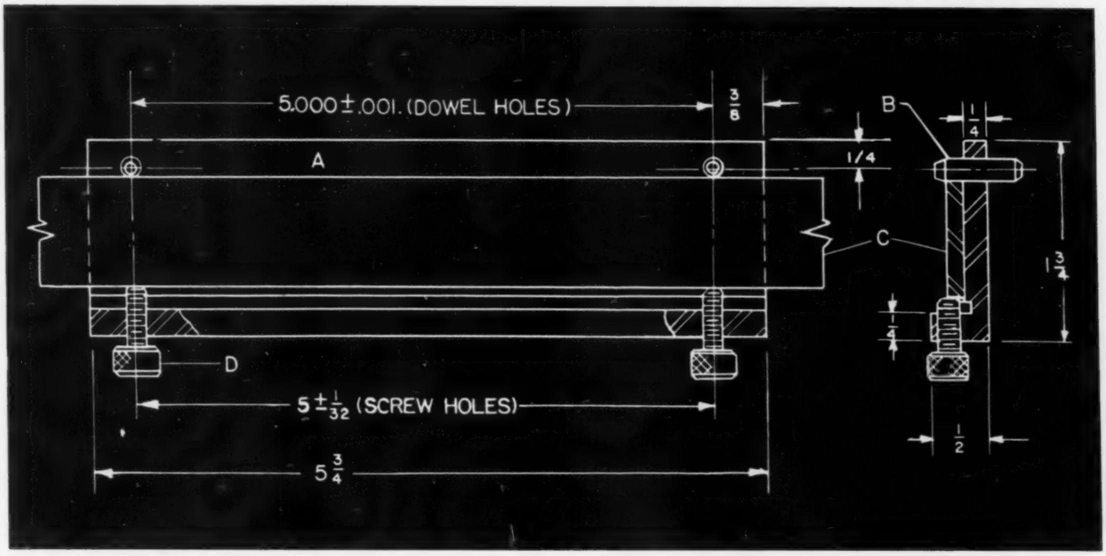
Sine Bar for Use with a Combination Square

H. J. GERBER, Stillwater, Okla.

The machinist's combination square equipped with a protractor head is an extremely versatile and useful instrument but the graduations on the angular scale are not fine enough for precise work. The sine bar here illustrated will, if carefully made, permit setting the instrument to an angle accurate within a few minutes of a degree.

Simple to make and easy to attach, this sine bar is convenient to use when a surface plate or other precision flat surface is available. A piece of flat bar stock is machined as shown in Fig. 1 to form the body A. The material is mild steel and no heat-treatment is necessary. There is only one highly critical measurement involved in the construction of the attachment. The two standard hardened and ground dowel-pins B must be spaced an exact distance apart, center to center. These dowels are 3/16 inch in diameter and are made a press fit in reamed holes.

Normally, the sine bar will be used only for setting scale C of the combination square to the desired angle. Therefore, it will not be necessary



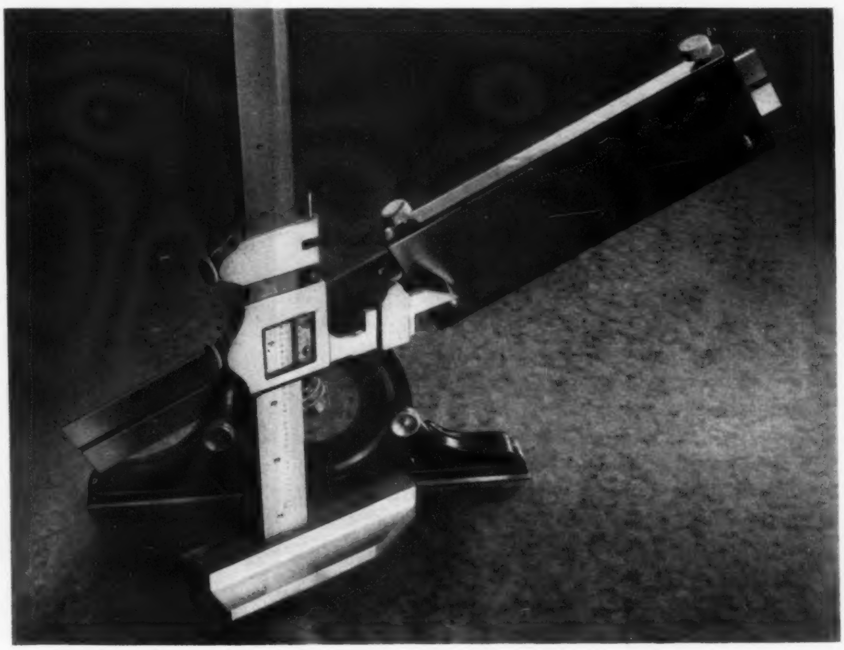
to machine the top and bottom edges of the bar to exact parallelism with the dowel-pins, unless these edges are to be used as gaging surfaces. Dowel-pins *B* serve two purposes. First, they act as buttons from which all measurements and settings are determined. In addition, by extending through the body *A*, these pins insure alignment of the edge of the blade with the buttons when the bar is clamped in place for use.

Two knurled thumb-screws *D* of any convenient size are provided. A 10-24 thread is suggested. When tightened, these screws pull the dowel-pins tightly against the lower edge of the blade and hold the sine bar in place while the angular setting is made. For convenience, this particular sine bar has been designed with a button center-to-center distance of precisely 5 inches.

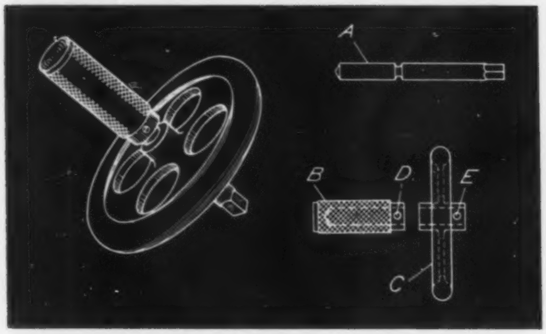
In use, a preliminary setting for the angle of the scale can be quickly made from the graduations on the protractor head. Then final adjustment is obtained by use of the sine bar. A vernier height gage is employed to set the angle of the blade precisely by measuring the vertical distance between the buttons on the bar (Fig. 2). This arrangement also serves as a double check against possible error.

Fig. 1. (Above) Sine bar for accurately setting the blade angle of a combination square that is mounted in the protractor head.

Fig. 2. (Right) A vernier height gage is used to obtain the vertical distance between the centers of the two pins.



SHOP KINKS



A wrench for lathe chucks which incorporates a handwheel to permit rapid positioning of the jaws.

Time-Saving Chuck Wrench

BUCKLEY SULLIVAN, Cleveland, Ohio

The jaws of a lathe chuck can be quickly adjusted by a wrench equipped with a handwheel. Such a wrench, here illustrated, is especially time-saving when used in the toolroom where new job setups are continually required. Although not intended for initial loosening or final tightening of the chuck, the arrangement is a considerable improvement over the conventional T-handle wrench for running the jaws in and out.

In construction, the wrench consists of three parts: shank *A*, handle *B*, and handwheel *C*. The shank is made from a bar of cold-rolled steel. It must have a diameter large enough to permit the machining of a key on one end to suit the chuck. An annular groove is provided near the opposite end of the shank. Cylindrical handle *B*, made from similar material, has a deep but blind concentric hole machined into one end. The handle is made a slip fit on the shank and is knurled on the periphery to provide a good grip. Set-screw *D* extends into the annular groove but is not tightened on the shank. This arrangement allows rotation of the shank within the handle and at the same time prevents their separation.

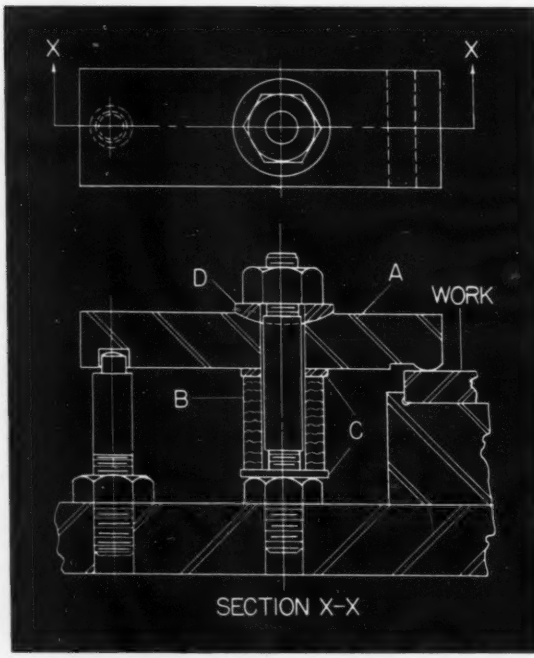
Handwheel *C* can be machined from an old gear or sprocket, the teeth being turned off and the rim rounded for easy handling. After boring the handwheel to fit the shank, the wrench can be assembled. Pin *E* is provided to secure the handwheel in place. In operation, the handle of the wrench is generally held in the left hand, and the right hand is used to rotate the handwheel.

Milling Clamp with Rubber Release

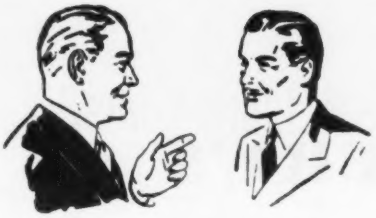
F. C. ELMO, Dayton, Ohio

Frequently the clamps on a milling fixture become inoperative because chips from the milling cutter are lodged in the spring that is commonly provided under the clamp strap to raise the strap from the work for reloading purposes. A good method of eliminating this problem is to substitute a length of hollow rubber cylinder under the clamp strap *A* (in the illustration) as shown at *B*. The rubber not only acts as a fine substitute for a compression spring but also serves as an efficient chip seal for the clamp stud.

The rubber cylinder should be cut from 1/16 to 1/8 inch longer than the compressed height between the washers *C* in order to allow for proper expansion when the stud nut is loosened. Washers *C* furnish firm seats for the top and bottom ends of the rubber member. A spherical washer *D* insures adequate clamping when the nut is tightened on the upper end of the clamp stud, and also lets the clamp float laterally.



The substitution of a piece of hollow cylindrical rubber for the common compression spring overcomes certain disadvantages of clamp springs.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Stop Those Leaks in the Supply Line

Have you ever discovered a hidden leak in the fuel line leading to your furnace? We have, and it suggests how important is a search for leaks in that indispensable line that feeds customer orders into a plant.

To increase sales in the face of growing competition, we are continually encouraged to spend, especially when costs become fictitious due to tax-avoiding bargains. But as pressures grow to make marketing more efficient, it will pay to search for small hidden losses. Their elimination can make a considerable reduction in the cost of sales.

A study of sales-cost savings in several medium- and small-sized machinery builders' plants shows five likely places to locate expense leaks. Why not have checks such as these made now as an aid to increased efficiency next year?

Sales-Expense Leaks Often Neglected

1. The cost of a change notice on an order is a concealed and expensive leak. There is a temptation to consistently blame the customer or our own engineers. We have seen one order of an off-standard machine which included twenty-six change notices. Twenty-one were termed customer changes. But in tracking these down, over half could have been avoided by greater attention to detail at the time the order was placed. Little errors often creep in during the pressure and enthusiasm of closing the sale, and sometimes essential information is not supplied. Make a check of the extent and causes of your change notices.

2. The hunt for unnecessary paper work is not romantic, but may be highly rewarding. We emphasize trimming elaborate statistical reports, because almost every sales department increases paper work disproportionately as it grows. Every dictated word is the first link in an expense chain.

3. Some service calls may needlessly drain the sales exchequer. You may train a service engineer to do more than correct trouble, but is the call itself always essential? One equipment sales manager who is keenly service-conscious checked these calls during the past year. He found about one-fifth of them could have been handled by a sales engineer without encroachment on useful selling time. Needed: a more careful screening of the request and a greater inclination by the sales engineer to roll up his shirt sleeves and make minor adjustments. Most service calls can be used as a springboard to sell. A spot study of service calls may reveal both waste and opportunity.

4. Travel invariably involves expense leaks. The question of renting versus owning cars may be unevaluated. Many trips are impulsively arranged and poorly planned. Doubling back frequently occurs. Of even greater importance from a study of travel costs is the relocation of sales engineers to match changing markets.

5. The location of the territorial sales office deserves attention to prevent expense leaks. The well-furnished metropolitan office with a fancy address may satisfy the ego and may invite nonpaying guests. However, it may be hard to reach from one's residence and be even more remote from the customer's. Industry decentralizes. Traffic gets worse. Suburbs offer improved office facilities. And besides, plant-selling is increasingly necessary.

Two questions arise as we attempt an organized study of expense leaks. Who should do the actual work? How best to utilize the results? A friendly assistant is not the best person for an impartial, analytical job. In a factory, inspection is a distinct and independent function from fabrication. Some dollar-conscious man from the accounting department or the comptroller's office may fit very well into studies of this kind.

In recent years management has concentrated on new products and expansion. With percentage as a popular measure for sales costs, increased sales have been a ready means to attain a greater published economy. People and facilities have been added to perform new and supporting functions. The race has gone on so fast and so long, that many of us get peevish when small possible savings are discussed. We can learn a lot from an efficient shop where each repetitive step is examined for penny savings.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Calculating a Punch Dimension

William W. Johnson

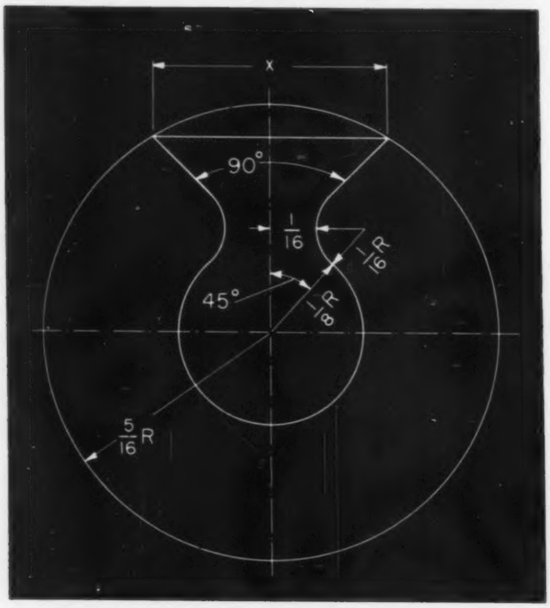


Fig. 1. Punch for which dimension (x) is required.

Dimension x on the piercing punch illustrated in Fig. 1 was calculated, using the diagram in Fig. 2, as follows.

Solution:

1. $b = \sqrt{(3/16)^2 - (1/8)^2} = 0.13975$
2. $c = \sec 45° \div 16 = 0.08839$
3. $a = 0.125 - c = 0.03661$
4. $m = b - a = 0.10314$
5. Using the law of sines,

$$\sin \phi = \frac{m \sin 135°}{5/16} = 0.23338$$

$$\phi = 13°29'46''$$

6. $\theta = 180° - (135° + \phi) = 31°30'14''$
7. Using the law of sines,

$$h = \frac{5 \sin \theta}{16 \sin 135°} = 0.23094$$

8. $x/2 = h \sin 45°$

$$x = 2h \sin 45° = 0.3266$$

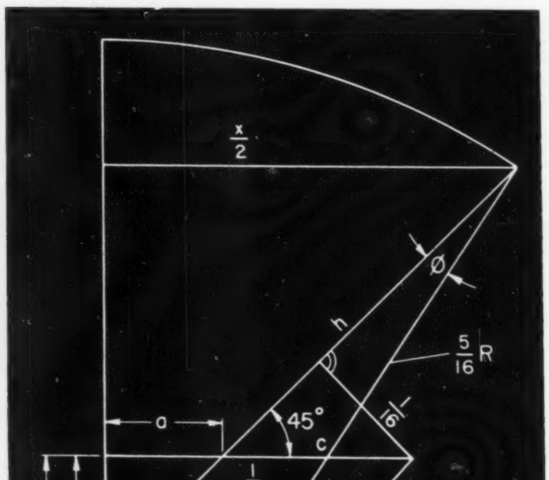


Fig. 2. Diagram used to calculate (x).

Semi-Annual Meeting of Gear Manufacturers

The 1957 Semi-Annual Meeting of the American Gear Manufacturers Association was held at the Edgewater Beach Hotel, Chicago, Ill., October 27-30. An informal Fellowship Hour and Buffet Supper was held in place of the usual formal banquet. Almost every facet of gear engineering was discussed at the various committee meetings, and six papers were presented.

A technical paper "Contact Ratio of Hobbed Spur Gear Pairs," written by Edward C. Varnum, head of operations research, Barber-Colman Co., and Merhyle F. Spotts, professor of mechanical engineering, Northwestern University, was delivered by Mr. Varnum. This paper presented numerical results in tabular form of the contact ratios for pairs of gears when standard conditions are met. One table is applicable when both gears of a pair are undercut, and a second table is used when neither gear of a pair is undercut. If one gear is undercut while the mating gear is not, both tables are used.

Formulas were presented for determining the contact ratio for non-standard pairs of gears. However, the tabular material and formulas presented are based on purely geometrical considerations. The materials from which the gears are made, elastic deformation, the effect of heat encountered during operation, and similar factors have not been taken into account.

Representatives of the Machinery and Allied Products Institute presented a paper "Business Investment Policy—Equipment Analysis as an Aid to Management." The paper presented a case study on the analysis of a surface grinding machine with a view toward possible replacement. "No Money for New Machines" was the title of a paper presented by J. H. Robbins, president, the American Pulley Co. Mr. Robbins described his company's program for replacing or modernizing equipment. A Capital Assets Replacement Fund, accumulated from an increase in the price of finished products based on estimated replacement costs, is used to supplement regular depreciation funds for such expenditures.

Fred Bohle, manager, machine tool development department, Illinois Tool Works, delivered a paper entitled "Towards More Economical Gear Inspection." Mr. Bohle expressed the opinion that the use of masters was the most satisfactory existing method of inspecting gears in production. He illustrated and described various methods of using master gears for inspection.

In a paper "A Typical I.B.M. Installation," T. M. Englehart, vice-president, Indiana Gear Works, described his company's methods of handling shop and production orders. R. J. Benson, Bell Telephone Laboratories, presented the results of a series of forty-eight tests (varying up to 2000 hours in length) in a paper entitled "Wear Studies of Fine-Pitch Gear Materials." The tests were conducted with hobbed spur gears (forty-eight-tooth pinions and ninety-seven-tooth gears), made of aluminum, steel, and nylon. The gears were subjected to reversals, changes in speed, and variations in temperature. Best results (least wear) were obtained with heat-treated, corrosion-resistant steel pinions and anodized aluminum alloy gears.

Plastic Material Tough Enough to Replace Metals

A polycarbonate-resin molding compound which offers a combination of toughness and heat stability, but which at present is only being used in a controlled testing program, has been announced by the Chemical Development Department, General Electric Co., Pittsfield, Mass. Called Lexan molding compound, it has a high impact strength (rods molded of the material can be driven into lumber like nails), a low water-absorption property, a 280- to 290-degree F. heat-distortion point, and good electrical properties.

The molding compound is a transparent, colorless to light-amber resin which has no odor or taste. It will be manufactured in the form of cylindrical pellets suitable for molding. Intended applications include gears, automotive parts, housings, rollers, electronic parts, and telephone accessories.

° ° °

Tables Facilitate Lathe Winding of Conical Coil Springs (Correction)

In the article on winding conical springs appearing on page 172 of November MACHINERY, the numerical values for *a* in the first line of the table in Fig. 2 were inadvertently reversed. This line should have read *a*, 0.437, 0.500, 0.562, and 0.625 instead of *a*, 0.625, 0.562, 0.500, and 0.437.

LATEST DEVELOPMENTS

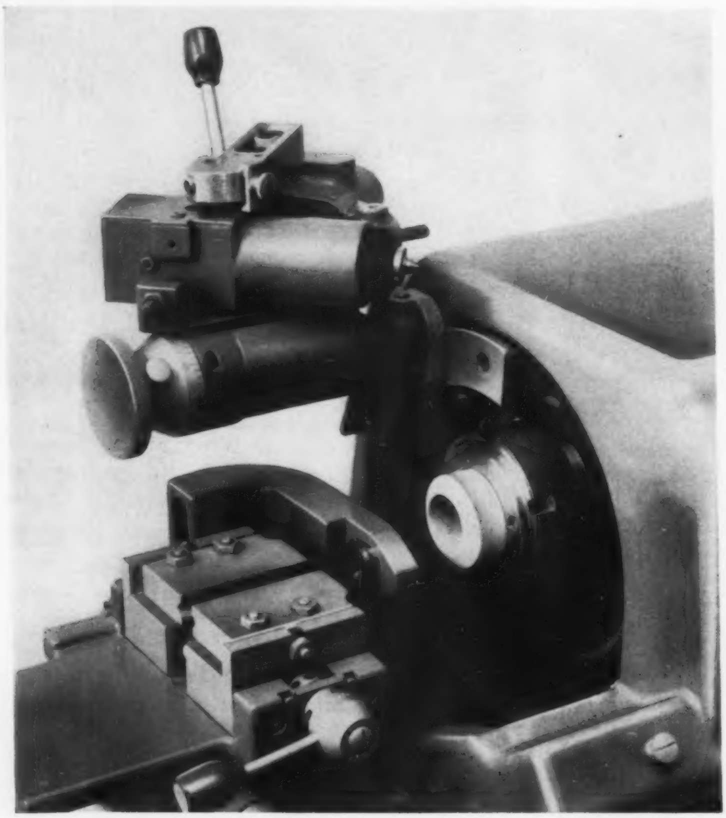
Machine tools, unit mechanisms, machine parts and

Spiral-Point Drill and Spiropoint Drill Sharpener

The Cincinnati Lathe & Tool Co., Cincinnati, Ohio, has developed a drill point of an entirely new design and is building a machine to accurately and economically grind the points of regular drills to the newly developed form. The form of the spiral point, as it is called, is shown in the lower view of Fig. 2 directly below a drill ground to the conventional chisel point. The Spiropoint machine developed to grind the new spiral point on regular metal-cutting twist drills is shown in Fig. 3 and in the close-up view, Fig. 1.

The method of generating the spiral-point shape is illustrated by the simplified diagram, Fig. 4. Here a straight line generatrix *a* terminating at the end adjacent to the axis in an arc of small radius *b* is rotated about the axis of the drill while being simultaneously reciprocated through small distances, both radially and axially, twice per revolution. These motions are controlled by a positive camming system. By a proper co-ordination of these three motions in magnitude and phase (with respect to the flutes of the drill) the shape of the end of the drill can be generated, as desired, to provide the following: (1) a true self-centering action; (2) a proper relief for the cutting edge; and (3) effective values of normal rake in the region close to the drill axis.

Many significant advantages over the standard chisel-point form are claimed for the spiral-point drill. According to data



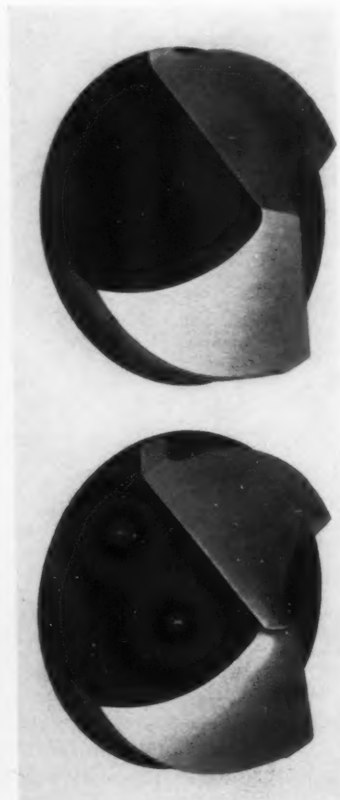
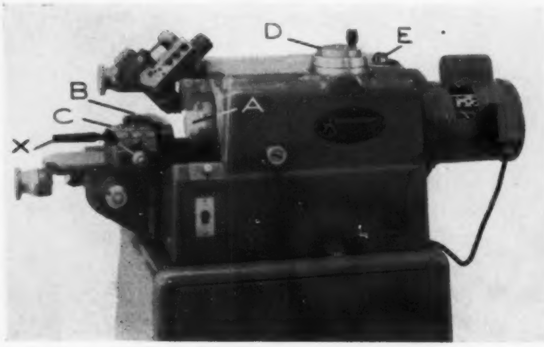


Fig. 1. (Left) Close-up view of Spiropoint drill sharpener built by Cincinnati Lathe & Tool Co. for grinding its newly developed spiral point for drills. Fig. 2. (Right, top) Conventional chisel-point drill. (Bottom) New spiral drill point.

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON



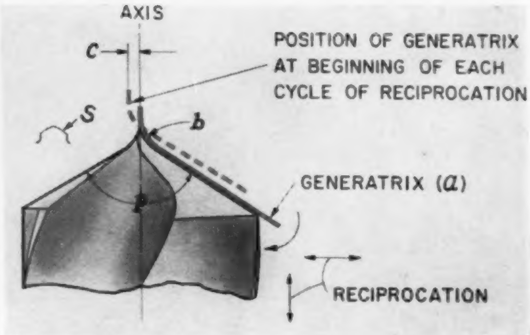


Fig. 3. (Left) Spiropoint drill-point sharpening machine brought out by Cincinnati Lathe & Tool Co. Fig. 4. (Right) Diagram illustrating generating principle applied in grinding spiral points on drills with machine shown at left.

compiled from extensive tests, it produces a rounder, straighter hole, which is truer to size; increases drill life; eliminates center-punching; reduces drill thrust force as much as 34 per cent; produces less work-piece distortion because of cooler cutting and reduced thrust force; maintains accuracy in hole positioning; reduces the need for secondary operations such as reaming, in many instances; and when applied to sheet metal, it produces a round, practically burr-free hole.

The remarkable advantages of the new drill geometry, or form, are found at its point. The spiral point terminates at its center in a sharp point S, Fig. 4. It therefore automatically centers itself on the axis of the drill when first engaging the work-piece. Wherever the spiral point touches the work, it enters and remains in that location. There is no tendency whatever to travel or "walk" to one side or the other as in the case of the chisel point shown in the upper view, Fig. 2. Therefore, it is usually unnecessary to use center-punched holes or guide bushings to maintain the proper location of a hole. In addition, the large negative rake angle found on the chisel point is greatly reduced. The photomicrograph of the cutting action of the spiral point in this area, shown in Fig. 5, demonstrates the improved efficiency of the new drill point, when compared with the same area on the chisel-point drill.

The sections shown in Fig. 5 were taken on planes perpendicular to the cutting edge of a spiral-point drill at radial distances of 0.010, 0.020, 0.030, 0.050, 0.140, and 0.240 inch from the axis. A series of similarly prepared photomicrographs (not shown) of the chisel-point drill at identical radial distances shows the angle near the axis of the drill at a radius of 0.010 inch to be −56 degrees for the chisel point as compared to only −27 degrees for the spiral-point drill. This same angular relationship exists at the 0.020- and 0.030-inch radii positions. At the 0.050-, 0.140-, and 0.240-inch radii positions the angle is the same for both types of points. Thus, in the sections close to the axis the difference is appreciable. With the spiral point the normal rake angle is much less negative; the shear angle is much higher; and the chip space ahead of the tool face is much greater. In the sections along the main cutting edge, there is no significant difference, however, as the rake angles here are virtually identical for both drills. Because of the more effective cutting action at the center and the larger chip space, we would expect a considerably lower thrust force for the spiral-point drill, and this is actually the case.

The spiral-point drill is not limited to one particular point angle or clearance. Both of the dimensions may be easily changed to give better performance for a particular material, or for a job which is difficult for drills having spiral points with standard point angle and clearance. In the drilling of sheet metal, the self-centering action of the spiral-point drill has been found particularly helpful, because with chisel-point drills it is extremely difficult to obtain a truly round hole, especially in thin, soft metal such as sheet aluminum. This is true of both power and hand drills. However, a further problem in drilling sheet metal, both with chisel-point drills and with the spiral-point drill as described thus far, is the "grabbing" of the drill as it breaks through the hole. This usually re-

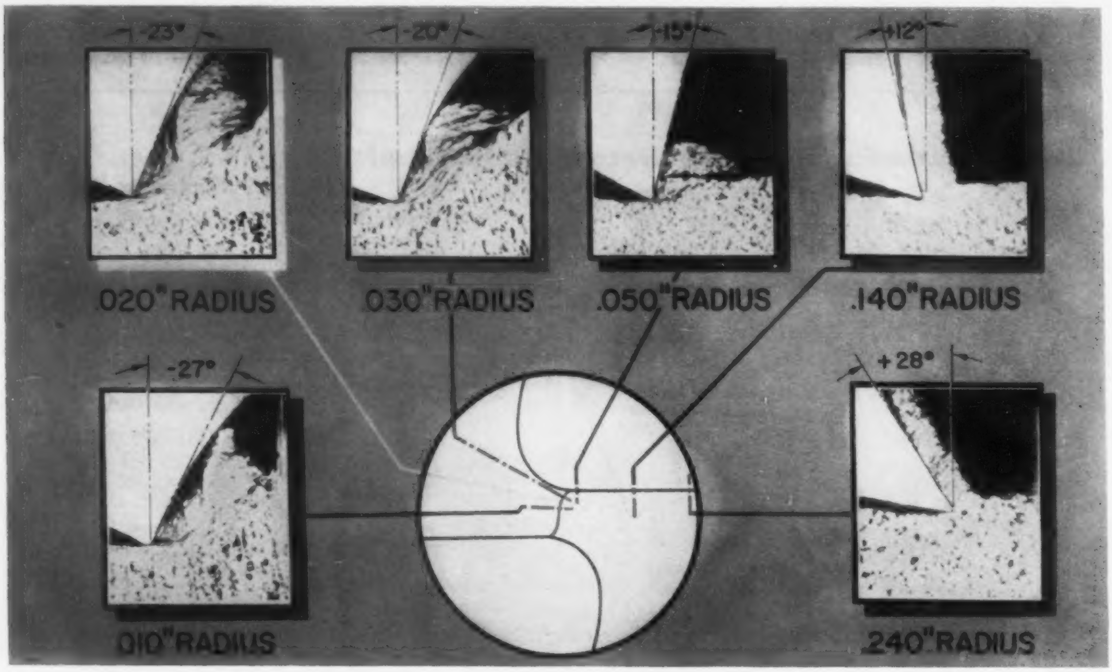


Fig. 5. Series of photomicrographs of sections through spiral-point drill and partly formed chips at successive points along cutting edge from axis to periphery.

sults in leaving a large burr on the under side of the hole. It was found that by modifying the point, both the burr and grabbing on breakthrough could be virtually eliminated, while still retaining the advantages of the spiral point.

This modification consists of merely changing the point angle of the drill from 118 to 180 degrees as shown in Fig. 6. However, the central portion of the drill point retains its characteristic spiral point extended ahead of the periphery and therefore contacts the work surface first, thus centering the drill. Just before breaking through the bottom of the hole (in sheet metal), a thin layer of the surface material is bulged forward by the spiral point; the peripheral portions of the cutting edges then act as trepanning tools to eliminate the burr.

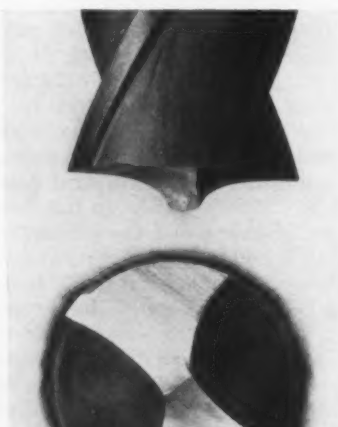


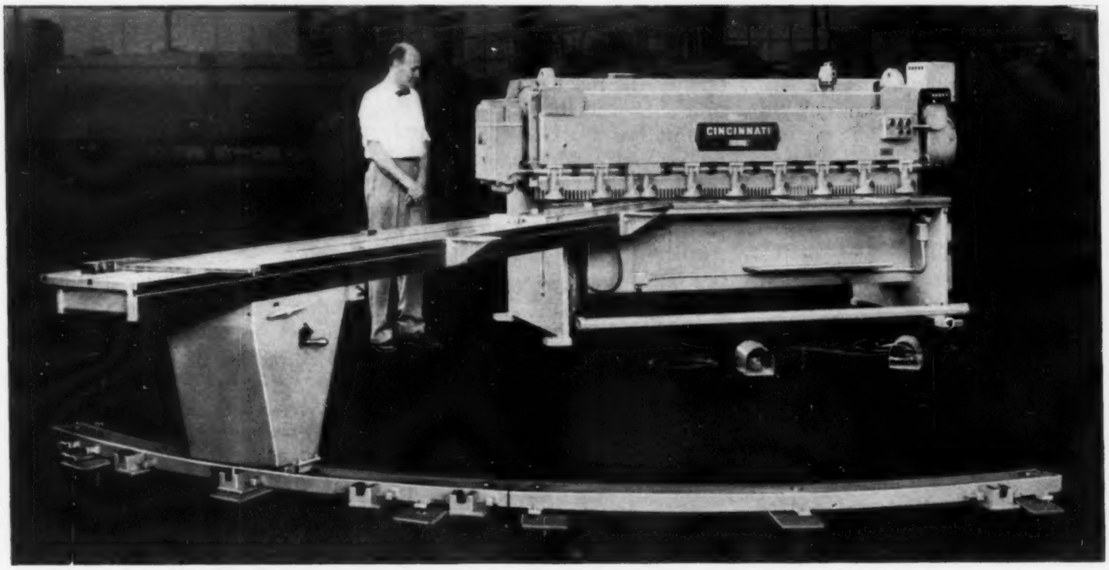
Fig. 6. Spiral-point sheet-metal drill.

The Spiropoint drill sharpener, Figs. 1 and 3, is so designed that the drill is held stationary, while the generating system gyrates around it. The small tubular grinding wheel *A*, Fig. 3, is mounted in a rotatable carrier and arranged so that the desired shape is generated on the end of the drill as the grinding wheel gyrates around the drill axis. An adjustable truing device is provided for the grinding wheel so that the point angle of the drill may readily be varied from about 90 to 180 degrees.

In operation, the drill *X* is oriented against a retractable control bushing *B* and clamped in the jaws *C*. It is then advanced so as to engage the continuously gyrating grinding wheel until the desired amount of stock has been removed. Thus, the entire sharpening operation is very rapid. A simple dial-indicated adjustment *D* provides the correct combination of radial and axial motions for the desired size of drill. Adjustment for values of relief above or below the standard amount (to meet special requirements) may be provided by rotating the second adjustable dial *E*.

From the results obtained with the spiral point in extensive laboratory tests and shop trials, it appears certain that this new drill point can make an important contribution to drilling practice, both from the standpoint of improved accuracy, quality of holes, and increased production. With the Spiropoint grinder, this three-dimensional spiral form can now be generated on any type or make of drill at a cost no higher than that for producing the conventional chisel point.

Circle Item 101 on postcard, page 233



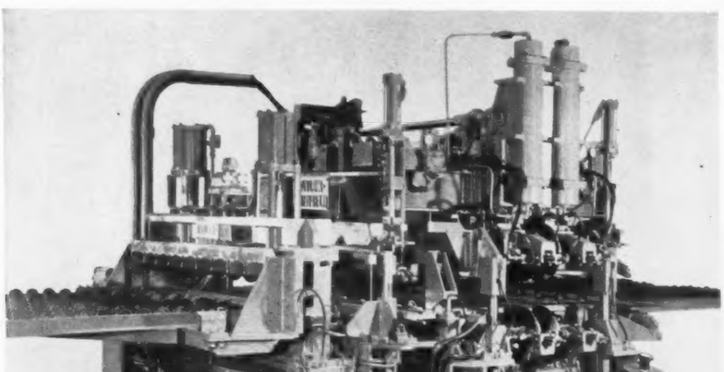
Shear with special gage announced by the Cincinnati Shaper Co.

Cincinnati Shear Equipped with Special Gage

A shear equipped with a special pivoted, angular shearing gage that makes it possible to accurately shear steel sheet at any one of a number of different design angles, within a total angular tolerance of only two minutes, has been brought out by the Cincinnati Shaper Co., Cincinnati, Ohio. The machine illustrated is equipped to shear transformer laminations varying in length from 7 3/4 inches to 15 feet. The material is silicon steel, electric grain oriented, 0.012 to 0.014 inch thick.

The pivot point for the angular shearing gage is in the shear table. The gage-support carriage travels on a floor-mounted track. Movement of the carriage from one to another of the angular gaging positions is rapid and simple. All gage stops are equipped with micrometer adjustments, which provide extreme accuracy in gaging the length of the sheared pieces. This accuracy is insured by the powerful hydraulic hold-downs of the shear, which clamp the work with a pressure of 5 tons. Operating speed of the shear is 65 strokes per minute.

Circle Item 102 on postcard, page 233



Taylor-Winfield special welder for joining aluminum alloy strips

Special Welder for Joining Aluminum Strips

A lap-seam resistance welder that joins successive strips of aluminum alloys for continuous processing at the plant of the Aluminum Company of America, Alcoa, Tenn., was designed and built recently by the Taylor-Winfield Corporation, Warren, Ohio. This welder handles alloys such as 61S, 24S, and 75S from 0.010 to 0.080 inch thick, in strips as wide as 64 inches.

Either plain or Alclad aluminum strip is fed into the welding machine prior to heat-treating. A built-in shear square-cuts the trailing edge of one uncoiled strip and the leading edge of the following strip. Four welding wheels move across the overlapped edges, joining the two strips.

Two 250-kva transformers power this welding unit. Mechanical transfer devices incorporated in the welder receive the strip, position it properly, and move it

toward the continuous heat-treating line after it is welded. The operator controls all operations from a nearby push-button station.

Circle Item 103 on postcard, page 233

Automatic Transfer Unit

A fully automatic transfer unit developed recently by Wagner Brothers, Inc., Detroit, Mich., for a large appliance producer is said to be adaptable to the solution of many mechanized materials-handling problems. This unit is currently used as an automatic, double-lane loader and unloader in a plating operation and can be used to transfer parts from conveyor hook to machine, from belt to machine, and from machine to machine. It is now employed to unload and load two racks at a time at the rate of 200 per hour each. Thus 400 racks are handled each hour. Each rack is designed to hold 300 pounds.

The transfer unit can be operated either hydraulically or electrically. Hydraulic power is used for short carriage strokes and electric power, for the longer strokes. In the test setup for the unit shown in the illustration, the reel at the left is used to supply power, but in a permanent installation, a safety power bar supplies the power. The cam seen in the foreground actuates all four of the pickup V-plates near the tops of the four upright columns through a system of mechanical linkages.

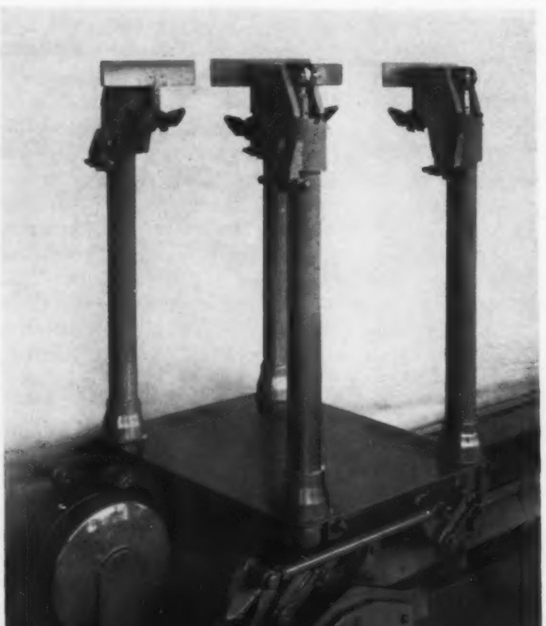
In operation the transfer setup picks up the work from two conveyor hooks and transfers it to the work-carrier hooks upon which the unfinished work is moved out of the loading station by the machine, and the finished work moved into its place. The transfer unit that dwells during the machine index then moves to the left, transferring the two finished work racks from the machine work-carrier hooks onto the two empty hooks of the conveyor which in turn had remained stationary during the preceding motion. The finished work is now indexed out of the conveyor-loading station and the unfinished work moved into its place. Then the cycle repeats. This principle also can be easily arranged for handling one rack at a time.

Circle Item 104 on postcard, page 233

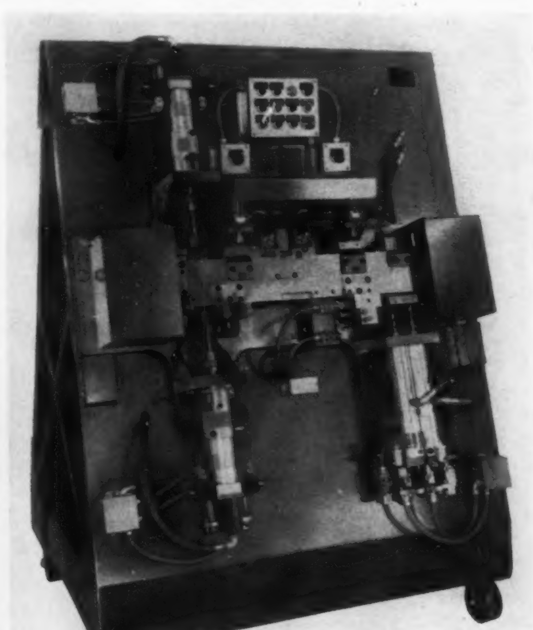
Special Machine for Drilling and Countersinking Six Holes in Radiator Grilles

Machines designed to drill and countersink six holes in right- and left-hand die-cast radiator grilles at cost-reducing, high-production rates have been designed and built by J. C. Thompson Tool & Die, Inc., Fort Wayne, Ind., for an automotive parts manufacturer. Because of the required close spacing of two sets of holes, indexing of the grille work-piece is necessary. The remaining two holes are spaced differently and are produced by individual drill units.

Automatic indexing is controlled



Test setup of automatic transfer unit placed on the market by Wagner Brothers, Inc.



Automobile radiator-grille drilling and countersinking machine built by J. C. Thompson Tool & Die, Inc.

by a panel of eighteen relays working with twelve signalling limit switches. The push-button control panel includes start and stop, and three-position Off-Manual-Automatic switches. Separate push-button switches individually operate each drill unit, index the slide, or actuate the clamp members for machine alignment or adjustments. An automatic switch serves to set up the circuitry for automatic operation of the machine.

Working components can be adjusted to perform the work cycle in approximately four seconds to practical precision tolerances. Electric and pneumatic circuitry controls and related components comply with JIC Standards. The machine is mounted on four 6-inch, heavy-duty casters for mobility. It is 5 feet wide, 4 feet deep, 7 feet high, and weighs approximately two tons.

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Torrington Spring-Making Machine

The Torrington Manufacturing Co., Torrington, Conn., has brought out a W-11A "Springmaker" which is a redesign of the company's well-known W-11 spring coiler. Easier set-up, improved location of controls, and generally simplified design of the W-11A machine are said to result in greater production capacity with a corresponding increase in accuracy. The torsion attachment, for example, has been recessed into a pocket in the front housing; and the clutch has been placed inside the machine, eliminating an outboard bearing bracket. A number of basic improvements have also been made in the construction and operation of the cutter mechanism and feed rolls of this improved coil-winding machine.

Circle Item 106 on postcard, page 233

H-P-M Open-Gap Press

A large 800-ton open-gap press, built by the Hydraulic Press Mfg. Co., a Division of Koehring Co., Mount Gilead, Ohio, was shipped recently to one of the large steel companies for use in heavy-forming and surface-hardening operations. The pressing area of the slide of this press is 72 by 48 inches. The bolster is 8 inches thick and has a pressing area of 72 by 60 inches. The throat, from the center line of the ram to the press frame, is 30 inches. The daylight capacity (distance from platen to bolster) is 48 inches. Ram diameter is 28 inches and the maximum length of stroke is 24 inches.

The press has a closing and opening speed of 575 inches per minute; a pressing speed of 35.6 inches per minute up to 800 tons. It is operated by the H-P-M closed circuit Fastraverse system with manual hand-lever and automatic press travel control. The H-P-M hydro-electric control system provides means for operating the press in any one of three different ways—manually, semi-automatically, or as a fully automatic machine. Changeover from one mode of operation to another may be made in an instant without stopping the press. Power is supplied by a 100-hp electric motor and an H-P-M radial piston oil-hydraulic pump having a capacity rating up to 95 gallons per minute.

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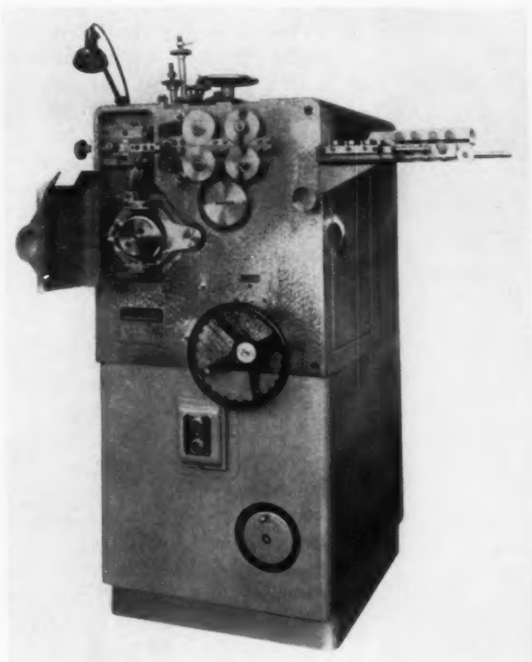


Torrington "Springmaker" spring-coiling machine

Large open-gap press built by Hydraulic Press Mfg. Co.

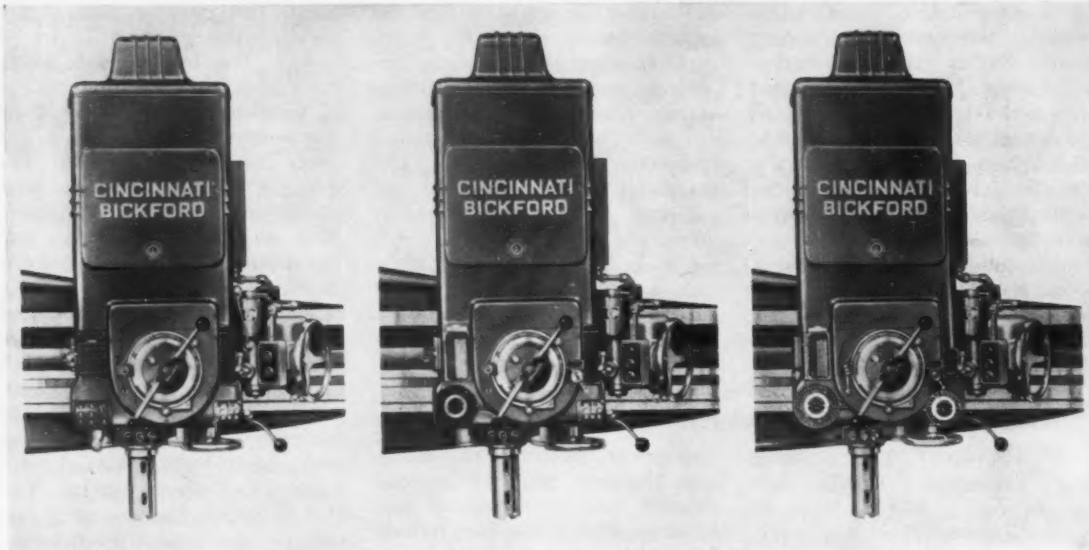


Fig. 1. Three new optional heads for Cincinnati Bickford radial drilling machines

Cincinnati Bickford Super Service Radial Drilling Machines with Improved Heads

Radial drilling machines with three newly-designed heads that incorporate many advanced construction and operating features have been announced by the Cincinnati Bickford Division, Giddings & Lewis Machine Tool Co., Cincinnati, Ohio. The three new optional heads with 100 per cent centralized operating controls are shown in Fig. 1. At the left is the standard lever-shift model in which all thirty-six spindle speeds and eighteen power feeds are controlled manually. In the center view is the partial pre-select model which has hydraulic control of all thirty-six spindle speeds with manual control of the eighteen power feeds. The complete pre-select model shown at the right has all thirty-six spindle speeds and eighteen power feeds controlled by two easy-to-read dials, one on each side of the head.

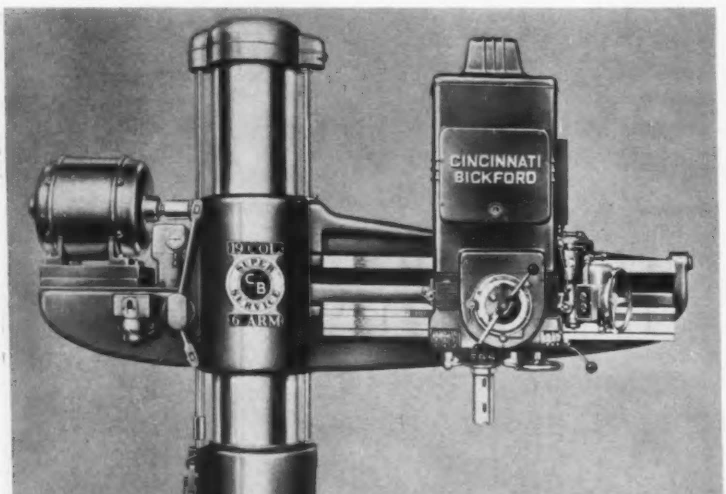


Fig. 2. Cincinnati Super Service radial drilling machine

The lever-shift radial drilling machine can be easily converted in the field to the complete hydraulic pre-select system for control of both spindle speeds and power feeds, or hydraulic pre-selection of speeds only. Other modern operating and design features built in these machines include an exclusive declutchable herringbone driving gear which provides the necessary power to drive large-diameter drills and heavy cutting tools for maximum penetration. Provision is made for declutching the herringbone gear when using small drills and taps requiring high spindle speeds and quick reversals.

A pre-loaded, four-bearing, chrome-nickel spindle and chromium-plated spindle sleeve are supported in a honed-head bore over 17 inches long to assure maximum rigidity regardless of the spindle position. Both arm and column are clamped hydraulically

from the operating position. Separate motors and complicated electrical controls are eliminated.

The head moves swiftly along the arm in either direction with power rapid traverse, operated by a directional lever which automatically disengages the traversing handwheel when power traversing is being used. A disc type clutch provides safe operation.

Two new sealed-beam work lights that never become hot, one on each side of the spindle, are impervious to damage from chips and coolant. These radial drilling machines are available with 13-, 15-, 17-, and 19-inch diameter columns; 4-, 5-, 6-, 7-, and 8-foot arm lengths; thirty-six spindle speeds up to 2300 rpm; eighteen power feeds from 0.004 to 0.125 inch with six positive-geared tap leads.

Circle Item 108 on postcard, page 233

Hammond Flat Finisher

Hammond Machinery Builders, Inc., Kalamazoo, Mich., has brought out a Model FF-6 flat finisher for wet-abrasive belt-grinding, polishing and deburring of flat work such as metal sheets, strips, bars, stampings, plates, etc., up to 6 inches wide by 6 inches high. Heavy-duty construction throughout and an endless conveyor belt with variable speed control have been incorporated in this machine to adapt it for high-volume continuous production. It is available with a single head, or, if several operations are necessary, it can be supplied as a multiple-head machine.

The abrasive belts are carried by two rolls: a powered contact roll and a tracking idler. Vertical adjustment is manually controlled and tensioning on the idler roll is maintained by adjustable air pressure. Head motors up to 7 1/2 hp are available.

An electromagnetic platen is used to hold material on the conveyor belt for positive drive under the contact roll. The magnetic force is variable to suit the size or mass of the work. Correct adjustment of the magnetic force allows parts to move easily off the platen without sticking, lagging, or piling-up on the conveyor. Hold-down rollers, positioned ahead of and at the rear of each contact roll, are used when non-magnetic material is to be processed. Spray, mist, fog, and splash are trapped by the metal enclosures around each head to insure a clean, dry work area.

Circle Item 109 on postcard, page 233

Pangborn Rotoblast Cleaning Table

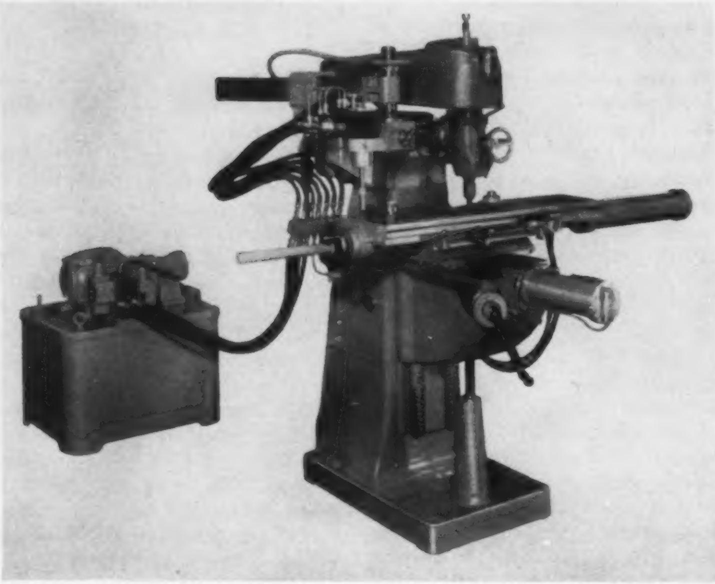
A four-foot Rotoblast table unit for cleaning castings, forgings, and stampings in foundries and plants that require a small, flexible machine for a wide range of cleaning operations was demonstrated at the National Metals Exhibition, Chicago, Ill., by the Pangborn Corporation, Hagerstown, Md. This new low-cost equipment is capable of Rotoblasting a 4000-pound load up to 48 inches in diameter by 24 inches high. A cast-labyrinth abrasive-sealing system makes the cabinet abrasive tight without rubber gaskets. The standard table is equipped with a single Rotoblast wheel, powered by a 10-hp motor which will throw 15,000 pounds of abrasive per hour while an optional 15-hp motor is available that will throw 22,000 pounds of abrasive per hour.

Also exhibited was a Pangborn hydro-finish cabinet for liquid blast-cleaning in process and maintenance operations; a Blastmaster barrel for batch blast-cleaning of castings, forgings, and heat-treated parts; and a unit type CN cloth-bag dust-collector.

Circle Item 110 on postcard, page 233

Hammond machine for wet abrasive belt-finishing of flat work

Rotoblast cleaning-table unit brought out by the Pangborn Corporation



U. S. Burke Machine Tool Division vertical milling machine equipped with two-dimensional duplicating attachment

Vertical Milling Machine Equipped with Two-Dimensional Duplicating Attachment

Vertical milling machines built by the U. S. Burke Machine Tool Division, Cincinnati, Ohio, can now be equipped with a two-dimensional table and saddle Turchan duplicating attachment for following irregular-shaped contours. This hydraulic two-dimensional tracer greatly simplifies intricate profiling and contour-machining. The 20- by 10-inch duplicating attachment is complete with pencil type stylus. The operator merely holds the stylus in contact with the ferrous or non-ferrous master and the tool automatically follows the prescribed movements in both horizontal planes at the predetermined optimum feeding rate.

To facilitate setup, the longitudinal table feed-screw is retained, permitting manual longitudinal-table movement in any position. An anti-backlash longitudinal-table feed nut is provided to assure the maintenance of accuracy. Among the optional accessories are a magnetic stylus, as well as an automatic rise and fall knee attachment coordinated to the movement of the table and saddle hydraulic cylinders.

The range and capacity of the U. S. vertical mill are in no way limited by the duplicating attachment. The machine illustrated has a 10- by 42-inch table. Twenty-four different spindle speeds in a range from 65 to 2850 rpm are available.

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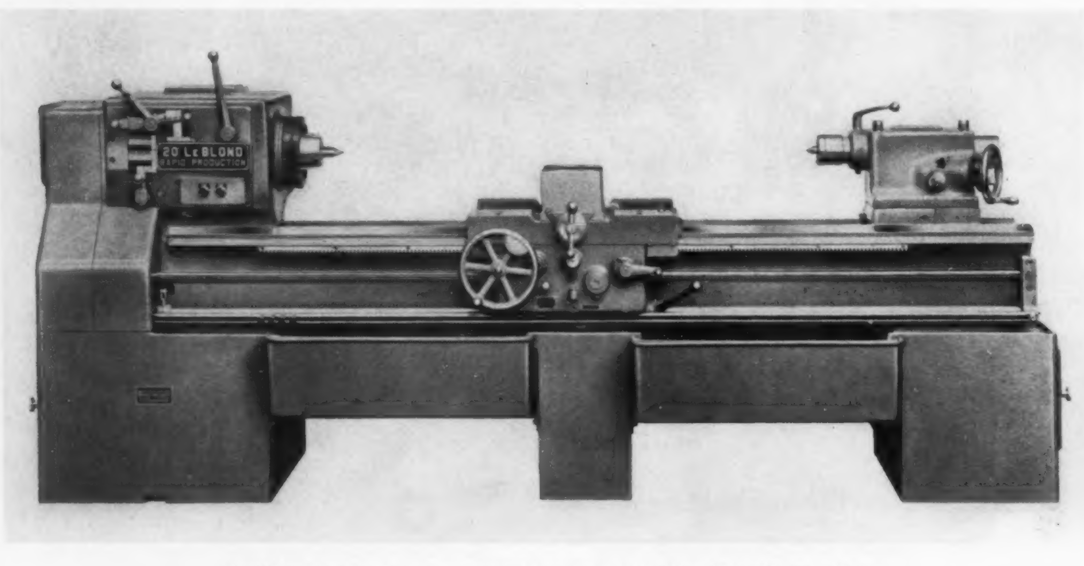
LeBlond Rapid-Production Lathe

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, recently announced a low-cost manufacturing lathe that is available with a wide variety of basic features and attachments which can be furnished to customers' specifications. This new LeBlond rapid-production lathe is available in 17- or 20-inch swing sizes. Its fundamentally simple design permits



Rapid-production lathe announced by the R. K. LeBlond Machine Tool Co.

the customer to add exactly the features desired.

The speed ranges available on the 17-inch lathe are 70 to 700 rpm or 105 to 1050 rpm. The 20-inch lathe can be had with a speed range of 57 to 600 rpm, or 85 to 900 rpm. Any or all of the following specific features are also available: Hydra-Trace (R) hydraulic tracing; automatic facing; air-operated chucks; quick-acting tailstock; connected rests; taper attachments; turret toolpost; and crosswise as well as length stops. The Hydra-Trace (R) attachment is said to transform the new LeBlond rapid-production lathe into an economical tracing lathe.

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Cincinnati Flamatic Heating Machine

A Flamatic selective flame-heating machine has recently been introduced by the Process Machinery Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio. This new machine embodies the building block principle of construction to provide a high degree of flexibility for a wide variety of flame-heating applications. Flamatic machines are designed primarily for heat-processing applications requiring high or low heating capacity, selective application of heat, precise temperature control, and automatic operation.

The basic element of the new Flamatic machine is a base unit of functional, flat-bed design which acts as the supporting member for a wide variety of work-holding and work-handling fixtures and flame heads. The base houses a large-volume quench tank with high-capacity heat exchanger, automatic-quench agitation system and a large work-removal conveyor which can be timed to work continuously or intermittently with each heating cycle, permitting delivery to be integrated with plant conveyor systems.

The rear portion of the base houses a mechanical controls compartment for work-handling fixtures and the upper portion is provided with mounting surfaces for work-holding fixtures and flame heads. Push-button controls for all machine functions are conveniently located on a control panel on the front of the base. A control unit, housed in a separate cabinet, provides accurate control of gas, oxygen, air, and water. Fuel gases such as acetylene, butane, propane, and natural or manufactured gas may be employed.

A separate rotating-spindle work unit is available to simplify the processing of the large volume of gears, pinions, shafts, cams, and other parts that are best handled by rotating them during the heating cycle. Spindle speeds are infinitely variable from 15 to 375 rpm. Automatic spindle retraction of 10 inches maximum at end of heating cycle instantly drops the work-piece into the quench tank below.

Rhomboid type flame heads with removable tips are normally employed in conjunction with the rotating-spindle work unit. Flame heads are carried in a universal type mount embodying three swivel movements, simplifying the positioning to any desired angular relationship with the work. To facilitate loading, flame heads are mounted on pneumatically actuated sliding mounts having a 4-inch retraction adjustment for each of the heads.

For many types of work, an important feature of the Flamatics is the accurate electronic temperature control which automatically terminates the heating cycle and causes the work-piece to be dropped into the quench tank when its surface temperature reaches the desired pre-set value. The "brain" unit which directs this highly accurate control of temperature is a remotely mounted electronic radiation pyrometer embodying a sensing element which accurately measures the surface radiation of the work-piece.

In addition to spin-hardening, with the standard rotating-spindle work unit, the building block principle enables the standard machine base and control cabinet to be used with other work-handling units and flame heads to provide efficient heat treating of a wide variety of non-related types of work such as spot-hardening, combination-hardening, brazing, etc. For many applications a single-power control cabinet can be used to serve several work processing units.

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Flamatic selective flame-heating machine introduced by the Process Machinery Division of the Cincinnati Milling Machine Co.

Niagara Power Groover for Lock-Seaming Operations

Push-button controls conveniently located at the center of the machine facilitate rapid operation of giant power groovers for lock-seaming operations brought out by the Niagara Machine & Tool Works, Buffalo, N. Y. These machines are driven by a direct-connected reversible gear-head motor with built-in brake that stops the carriage quickly for the rapid return stroke. A built-in zero speed switch protects the motor and gears from overload by preventing reversal when the carriage is still in motion. The carriage is driven by a pair of endless chains and is returned to the starting position automatically by means of a limit switch which reverses the drive.

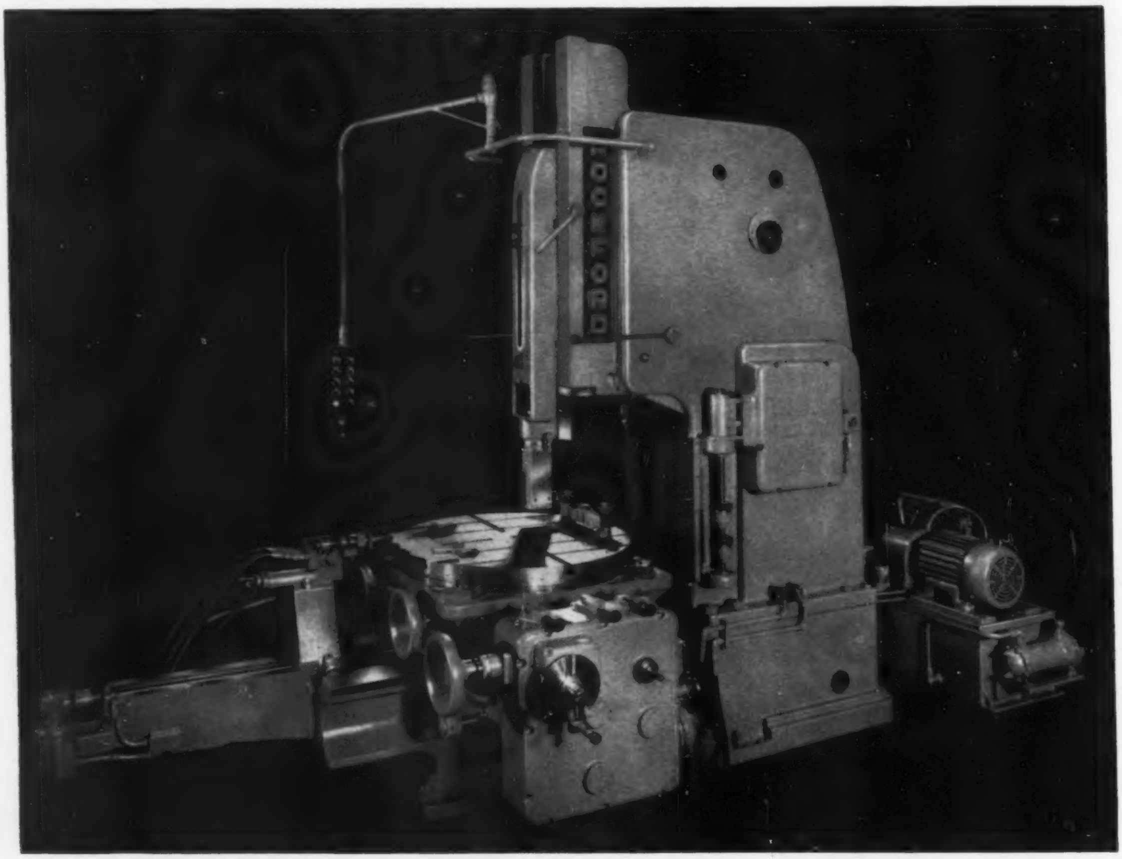
With eight models available for single or Pittsburgh lock type seaming, the new Niagara giant power groovers can be obtained with working lengths from 4 to 10 feet for handling up to 16-gage mild steel.

Power groover for lock-seaming built by Niagara Machine & Tool Works

Circle Item 114 on postcard, page 233

Hydraulic Slotter Equipped with Duplicator

A new 20-inch hydraulic slotter, manufactured by Rockford Machine Tool Co., Rockford, Ill., is capable of both conventional slotting and complicated tracing work. This machine is designed to



Hydraulic slotter equipped with duplicator announced by the Rockford Machine Tool Co.

permit changing quickly from standard work to tracer work and vice versa. A transverse movement of the slotter table makes rotary or straight work possible. Equipped with the highly sensitive Kopy-Kat duplicator, this new slotter will produce its own working templates from a toolroom master or from a finished work-piece. In addition to the powerful hydraulic fulcrum drive to the ram, this new slotting machine has pendant-controlled cutting-speed changes; hydraulic feeds and power rapid traverse in all directions; dividing head; and stroke-length adjustment while the ram is in motion.

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Kaukauna Floor Type Horizontal Boring, Drilling, and Milling Machine with Three Control Systems

The Kaukauna Machine & Foundry Division of the Giddings & Lewis Machine Tool Co., Kaukauna, Wis., has developed a new binary code tape control system for the Kaukauna line of floor type horizontal boring, drilling, and milling machines. This development is said to make machine tool automation possible for all phases of industry, from the small job shop to the large mass-production plant.

The Kaukauna automatic system of machine tool control was designed to permit operation of a well-known type of standard machine tool by three methods: standard manual control; dial control of discrete digital dimension information; and eight-channel binary code punched tape. This system has been applied to a 5-inch spindle Kaukauna floor type horizontal boring, drilling, and milling machine with a vertical travel of the headstock on the column of 72 inches, and a horizontal travel of the column on the runway of 120 inches.

This basic machine can be selectively controlled as follows: First, from a standard control panel, using electric buttons to manually control the machine just as it was originally controlled; second, through a digital dial control input system of discrete dimensional data, where the operator dials precise dimensions into the machine directly from the work blueprint; and third, by complete tape control which furnishes dimensional data to the machine from previously calculated decimal information taken from the work blueprint.

The Model 3040 floor type horizontal boring, drilling, and milling machine, shown in Fig. 1, is under tape control, performing precision tapping, drilling, and boring operations on an end frame for the printing unit of a headliner press. This machine, with full tape control of 96 inches of vertical head travel and 144 inches of horizontal column travel, is installed with a 60- by 96-inch traversing airlift rotary table to carry the work-piece. The spindle speeds range from 20 to 1200 rpm and the spindle feeds are from 0.0035 to 0.062 inch per revolution.

A zero offset device permits adjusting the measuring system so that measuring can be accomplished from any point along the head or column travel movements. Input information is obtained from a previously prepared eight-channel binary code paper tape. The actual typing of the manuscript and punching of the tape is done by a typist on a commercially available typewriter and tape producer.

The precision numerical dial and tape panel, Fig. 2, is located on the headstock of the machine. Dimensions can be inserted into this machine measuring system for any length of unit travel up to 96.000 inches for the head and 400.000 inches for the column. The precision meters illustrated

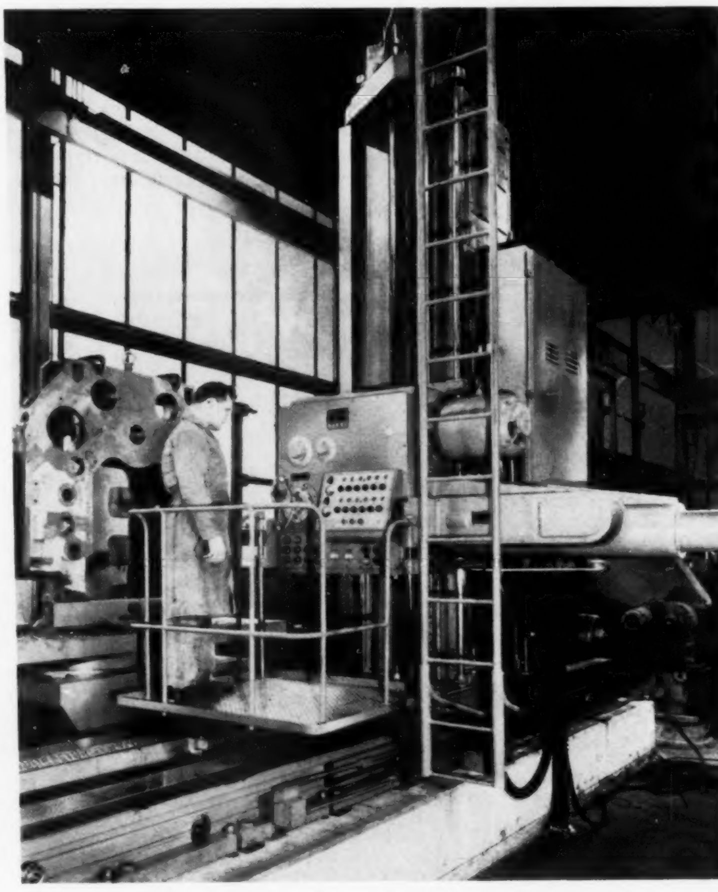


Fig. 1. Kaukauna floor type horizontal boring, drilling, and milling machine equipped with full tape control

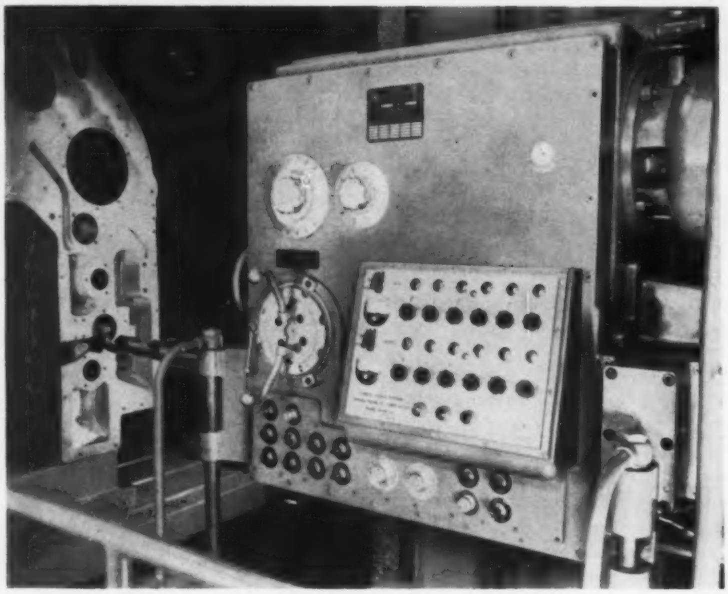


Fig. 2. Precision numerical dial and tape panel on headstock of machine shown in Fig. 1

indicate accuracy of machine location in both directions to 0.0001 inch.

The zero offset control permits the establishment of 0-0 at any point in the coordinate measuring system. All measurements are made in reference to this 0-0 point. No accumulation of error is possible. Selection of manual, dial, or tape operation is made through the selector in the machine panel. Unique control in any type of operation permits interruption of tape control to add manual or dial movements. Returning to tape control immediately continues the process as though uninterrupted.

Fig. 3. Tape transport cabinet of automatic electronic control system of machine illustrated in Fig. 1

The tape transport cabinet for the automatic electronic machine control shown in Fig. 3, is located on the door of the control cabinet of the machine. This mounting assures accessibility to all units and facilitates maintenance of the machine.

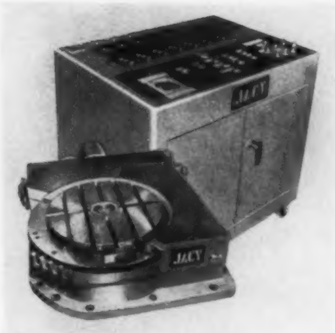
Circle Item 116 on postcard, page 233

Jacy Precision Digital Index-Table

Modern Engineering Service Co., Berkley, Mich., has announced their Jacy precision digital index-table which can be push-button or punched-tape programmed. This numerically controlled machine is said to be accurate to seconds of arc. Versatility is provided by the digital electronic control of a mechanical index mechanism that permits infinite resolution from 1 to 21,600 divisions of a circle. Repetitive indices are accurate to within one second of arc.

The index-table is available in 18-, 24-, 36-, and 45-inch diameters and has a solid mechanical lock with zero backlash which is automatically engaged in all index positions. This, plus the inherent accuracy, is claimed to eliminate all need for multi-hole bushing plates normally used on circular rings and diameters on single-spindle drilling operations. Compensation for size change of the work-piece due to fabrication or thermal conditions during manufacture is easily made by the block-indexing control feature or through the flexibility of the positioning system.

Jacy index-tables are built to machine tool standards and driven by either hydraulic or electric units. They will operate accurately and efficiently under substantial work loads for such machining operations as drilling, milling, boring, broaching, etc. Economies are effected in both tooling and manufacturing since no cams, tapes, bands, index-plates, or change gears need be purchased or manufactured.



Jacy precision index-table and mobile console control announced by the Modern Engineering Service Co.

The mobile electronic console contains both manual and automatic push-button controls and punch keys for immediate programming of any desired indexing operation. The Jacy table can be adjusted to an infinitely variable high speed for minimum index time and to an infinitely variable creep or jog speed which is provided for set-up operations and shockless lock-up.

Circle Item 117 on postcard, page 233

Bliss Die-Handling Machine

The E. W. Bliss Co., Canton, Ohio, has announced a new die-handling machine designed to simplify and speed assembly and disassembly of both large and small die sets. It replaces the chain falls, sledge hammers, and heavy manual labor usually employed for this work; and it eliminates the problem of bent leader pins. Using this machine, an operator can assemble or disassemble large die sets within a few minutes. Built in capacities for different sizes of die sets, the machine shown handles sets weighing up to 7000 pounds and as large as 24 inches by 66 inches.

In disassembly a die set is rolled onto the ball transfer table from a lift-truck and positioned under the slide frame, which is lowered electrically over the top die-shoe. The slide frame is then clamped to the top shoe by means of a hand crank, and the top shoe is lifted off by raising the slide frame electrically.

After the top shoe has cleared the bottom shoe, it may be rotated to any desired angle and held there for minor repairs. This feature also permits turning the shoe over completely and setting it on its back on the ball transfer table for removal and bench work. Assembly of a die set is accomplished simply by reversing the disassembly procedure.

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Young Open-Side Planer with Hydraulic Drive

A Model 24P open-side planer built by the Young Machine Tool Division of the Young Testing Machine Co., Bridgeport, Pa., has been installed in the plant of a large Eastern steel company. This planer is hydraulically driven by a 15-hp motor. It will take work up to 36 inches wide by 36 inches high and has a 6-foot stroke.

Features include independent side-head feeds, automatic cross-rail clamps, rapid traverse to all heads and slides, and force-feed lubrication to the ways. The entire machine is controlled from a pendant station and feeds and speeds are instantly set in a few seconds.

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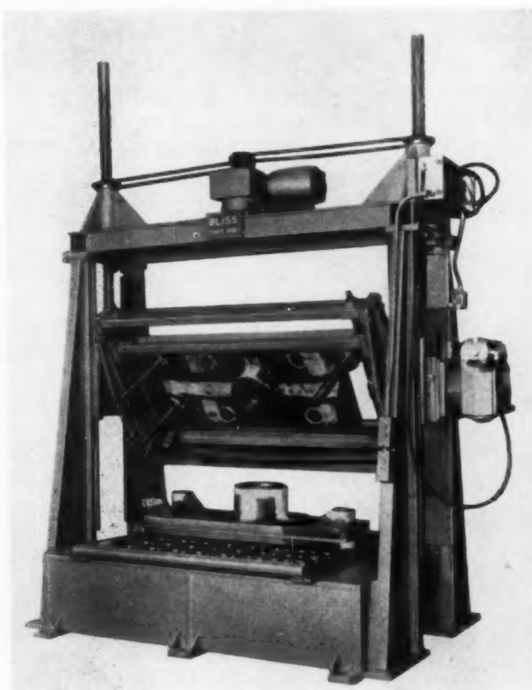
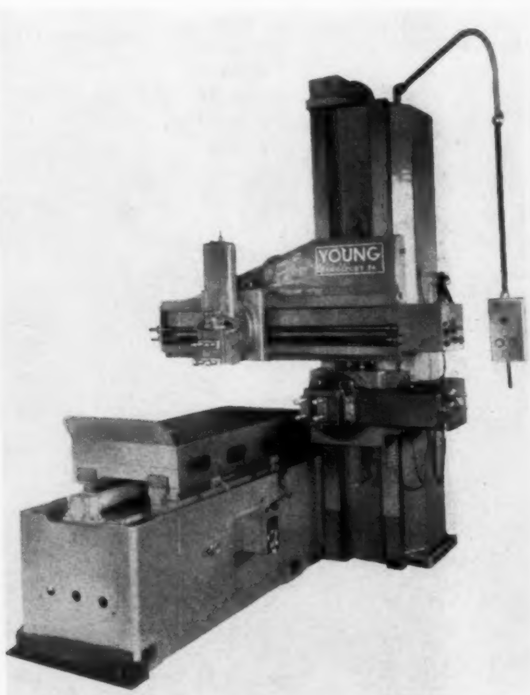


Die-handling machine placed on the market by the E. W. Bliss Co.



Hydraulically driven open-side planer announced by Young Machine Tool Division

Snyder Special Rotary Index Machine for Processing Automotive Parts

Fifty different universal-joint flanges are faced, bored, counter-bored, undercut, drilled, and chamfered on a special versatile five-station rotary index machine designed and built by the Snyder Tool & Engineering Co., Detroit, Mich. Flexibility of the machine, which applies automation concepts to low-volume production, is achieved by providing interchangeable fixture members, drill heads, and cutting tools. Concentricity accuracy of 0.004-inch true indicator reading between the bored flange diameter and the pitch diameter of a splined hole in the part is maintained by this machine which produces up to ninety-six pieces per hour.

Standard Snyder way type machining units powered by three separate hydraulic power packs are used in each of the four machining stations. These machining units have replaceable hardened-and-ground ways and are provided with automatic pressure lubrication. The five work fixtures are mounted on a Snyder standard rotary index-table actuated by a hydraulic cylinder and shot-pin mechanisms. Push-button electrical controls are provided for the hydraulically operated machine which occupies a floor space about 12 by 19 feet.

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Snyder rotary index machine for processing fifty different parts

Solid-Carbide Blades for Counterbores

More cuts per grind and higher cutting speeds for very abrasive, non-ferrous metals such as aluminum, bronze castings, cast iron, sand castings, and other difficult work-pieces are possible through the use of solid-carbide blades now available for use in adjustable spot-facers and counterbores made by the Robert H. Clark Co., Beverly Hills, Calif. The blades are molded to exact shapes, sintered, and supplied in carbide grades for specific applications. They can be procured with cutting edges unground or ground for specific metals. When ordering blades, the material to be cut should be specified to insure correct grinding. Clark counterbores are available with either M-3 high-speed steel blades or with solid-carbide blades.

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Die-handling table announced by the Hamilton Tool Co.

Die-Handling Table

A die-handling table called "Big Beulah" has been added to the line of Portelvators (portable elevating tables) manufactured by the Hamilton Tool Co., Hamilton, Ohio. This table rolls and turns, lifts and lowers, pushes and pulls loads up to 2500 pounds. It transports and slides dies to another surface without manual strain or risk of damage to either load or operator. Although specifically designed for transporting dies from storage to press, this table can be used also for a wide variety of everyday lifting and moving.

The reinforced top-plate has an area of 748 square inches (22 by 34 inches) and is fitted with eight recessed, free-rolling conveyor rollers to facilitate moving loads. A ram, impelled by a screw-and-nut device, travels the length of the top-plate, pushing loads from table to press or storage shelf, and pulling loads from press or storage shelf to table. Ram front extension provides means for pushing load into press or onto shelf a maximum of 14 inches from front edge of table top-plate. This front extension is hinged to the ram by means of a pull-pin and may be swung aside or demounted at will. Vertical movement of top-plate is 25 inches—from 35 inches minimum to 60 inches maximum above floor level. A floor-lock and two turn-buckle hooks prevent movement of the table during loading and unloading.

Circle Item 122 on postcard, page 233

Morton Floor and Planer Type Horizontal Boring and Milling Machines

The Morton Manufacturing Co., Muskegon Heights, Mich., has announced a new line of horizontal boring and milling machines that features a square-ram mounting for the spindle. The rotating spindle and its bearings are mounted in the square ram and move horizontally with it as one unit. This feature increases the rigidity of the spindle and assures a high degree of accuracy, even when the ram is fully extended. It is claimed that the square-ram design has increased spindle rigidity at least five times and that it facilitates working in restricted areas.

The new line of machines includes the Model B and Model BC floor type boring and milling machines. The Model BC features column cross-travel. Likewise the Model P and Model PC planer type boring and milling machines are being offered with the Model PC featuring column cross-travel. These four models are available in a square-ram size range of 9 to 14 inches with an enclosed-spindle size range of 6 to 10 inches. A smaller series, with an 8-inch square ram and 5-inch spindle diameter is offered in the Model LB floor type and Model LP planer type machines. The square-ram design is shown on the Model PC planer type machine illustrated.

The combination of rotating spindle and square ram, with the ram as a rigid member, allows unlimited accessory applications at extended distances without need for accessory supports. A complete new line of quick-change and bolt-on accessories including right-angle milling heads, speed-up heads, right-angle slotting heads, and many other attachments can be positioned within the full machine range. Other accessories such as tapping attachments, boring bars, work tables, and floor plates are also available.

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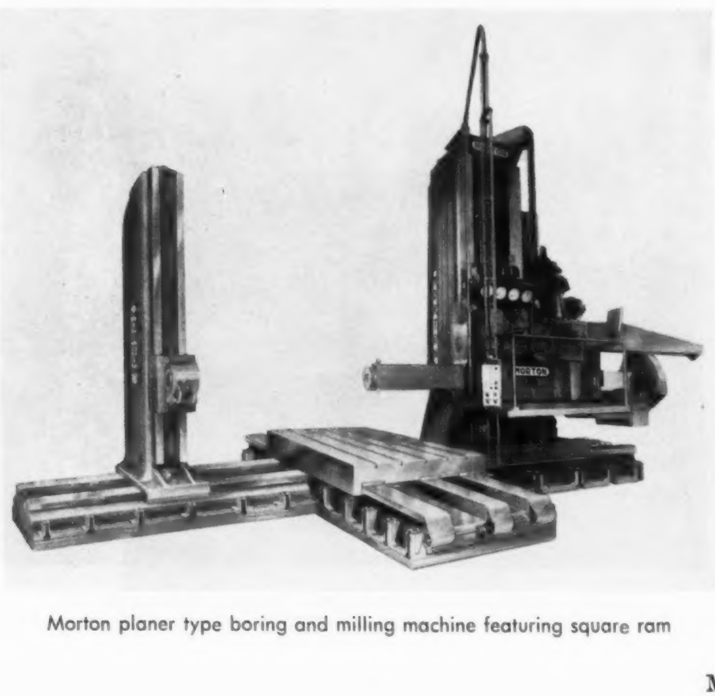
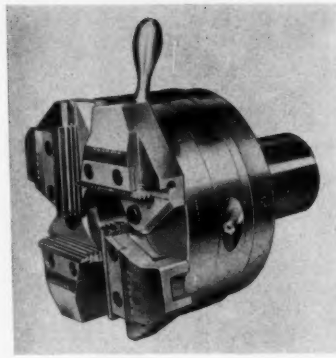


Morton planer type boring and milling machine featuring square ram

Landmatic Stationary Type Die-Heads

The Landis Machine Co., Waynesboro, Pa., recently announced the development of new 3- and 4-inch Landmatic heat-treated, stationary type die-heads. The heads of this new line, for application to turret lathes and other machines employing stationary type heads, are designated Type A and are designed to replace the former 3- and 4-inch Type Z Landmatic die-heads.



Landmatic heat-treated stationary die-head developed by the Landis Machine Co.

Standard ranges of the Type A heads are 3-inch A: 3/4- to 3-inch U.N.C., 3/4- to 1 1/2-inch U.N.F., and 1/2- to 3-inch pipe; 4-inch A: 1- to 4-inch U.N.C., 1- to 1 1/2-inch U.N.F., and 1- to 4-inch pipe. With over-size chaser holders, the 3- and 4-inch Landmatics will produce short thread lengths no coarser than 6 pitch from 3 1/8 to 5 1/2 inches and 4 1/8 to 6 1/2 inches in diameter, respectively.

Self-opening or pull-off action is effected by interrupting the forward travel of the turret slide or carriage. Positive and uniform head-opening action permits threading close to a shoulder with safety. The head is manually closed by a conveniently located handle.

When required for coarse pitch threading, an integral roughing and finishing attachment can be incorporated during head construction. This attachment allows roughing and finishing cuts without disturbing the die-head size adjustment. Thus, the final cut will produce a thread of excellent finish with exact duplication of size in accordance with the predetermined size adjustment. Both heads are equipped with Landis tangential chasers which are usable for 80 per cent of their original length and require removal of only a few thousandths inch of metal to restore the cutting edge. When regrinding, it is unnecessary to remove the same amount of metal from each chaser.

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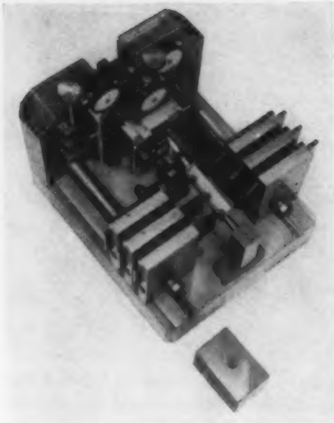

Shepard & Young universal gage

Universal Precision Gage for Checking Jet Blades

A universal precision gage for checking the accuracy of jet engine blades is now available from Shepard & Young Tool Co., Detroit, Mich. The gage features airfoil template holders that are adjustably mounted on hardened and ground ways on the base of the unit. The template holders are positioned by interchangeable master gage bars. This patented design enables blades of any length to be checked while consistently maintaining template alignment accuracy of 0.0002 inch.

The gage can be quickly changed to check different blades. This is done by changing template holders, master gage bars, template set master, and part-clamping details. The template-set master engages notched surfaces on the template forms and proves the accuracy of the flush-ground ends of the forms with the template holders.

The jet blade to be checked is positioned in a clamping device where it is located axially from the blade-mounting surfaces. The clamping device is swivel- and slide-mounted to indicate both blade twist and displacement. Indicators with 0.0001-inch readings indicate the accuracy of the swivel and displacement measurement on the blade. The templates engage the foil section of the blade to indicate form accuracy as well as blade tilt and bow.

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Natco Automatic Machine for Processing Bearing Housings

Twenty-five different bearing housings for electric motors can be drilled and tapped on a new automatic machine brought out by the National Automatic Tool Co., Inc., Richmond, Ind. This machine will handle front and rear housings for electric motors with NEMA frames ranging in size from 182 to 326 in both open and enclosed types. The housing is loaded in a horizontal position with the open end up. Two grease holes are drilled and tapped in a horizontal plane in the rear housings of enclosed motors. Open motors have three holes drilled and tapped in the vertical plane for mounting an air deflector.

Housings of different sizes can be accommodated by selecting the correct locating plates from the fourteen available. The locating plates take into account minor variations in depths and diameters of the housings. Adjustments for major variations in depth and diameter are made by moving the drilling and tapping units forward and backward. Handwheels permit easy adjustment, and accuracy of location is assured by dowel-pins which can be set to provide any of four major adjustments. Tool changes are made quickly in most cases by using pre-set tools.

The six-position rotary table makes it possible to process the holes on the different castings which have varying hole locations. On some parts, all positions are used whereas on other parts several positions are skipped. A four-position selector switch on the electrical cabinet determines the positioning of the table and also which heads are to move forward.

One man operates this machine as well as an adjacent adjustable-arm vertical driller on which the through bolt holes are drilled. Cycle times are comparable so that the operator can unload and load one machine while the other machine is cycling. Production rates range from 24 to 42 parts per hour, depending on the housing being processed.

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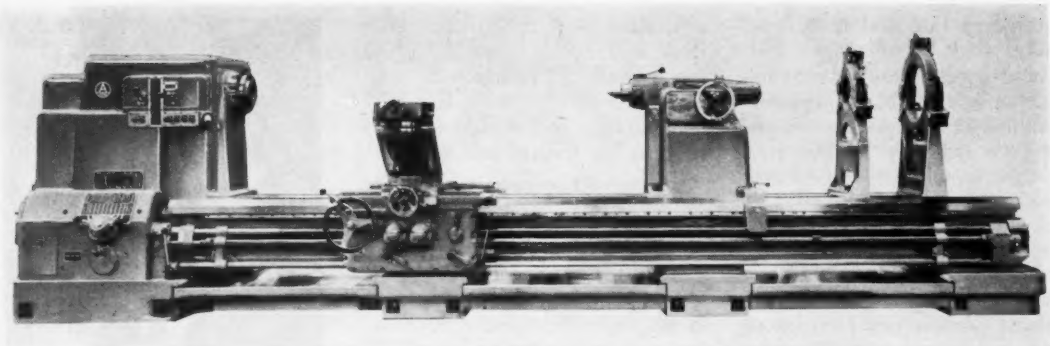
Automatic machine for processing electric motor bearing housings brought out by the National Automatic Tool Co., Inc.



Axelson lathe developed to handle large-diameter, odd-shaped work

Large Swing Lathe for Odd-Shaped Work

A Model 6049F lathe designed for turning large-diameter and odd-shaped work-pieces that has a swing of 60 inches over the ways and 49 inches over the cross-slide has been added to the new line of machines brought out by the Axelson Mfg. Co., Los Angeles, Calif. The headstock is driven by a 40-hp motor and has twenty-four spindle speeds in true geometric progression, ranging from either 6 to 750 rpm or 3 to 375 rpm, forward or reverse rotation. Two levers control all twenty-four speeds. A simple direct-reading speed plate indicates spindle speed by the position of the levers. A horsepower meter built into the headstock is readable from all operating positions.

Anti-friction bearings are used throughout. Gears are made from alloy steel, hardened and precision-ground for smooth, quiet operation. Constant lubrication is provided for all gears and moving parts. The totally enclosed gear-box provides eighty-one feeds and forty-five leads. The one-piece tailstock is designed to assure maximum rigidity, eliminate bolt stretch, and transmit heavy forces to the bed section. An extra heavy box type apron is completely enclosed with the exception of the rack pinion. All gears and shafts operate in a continuous oil bath provided by a built-in pressurized system.

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Special double-end machine announced by the Hartford Special Machinery Co.

Hartford Special Double-End Machine

Parts up to 28 inches long can be drilled, centered, spot-faced, chamfered, reamed, tapped, threaded, hollow-milled, or bored on a versatile machine announced by the Hartford Special Machinery Co., Hartford, Conn. This machine is designed to perform opposed operations simultaneously and may be used with a small index-table, manual or air-clamp fixtures, hopper or vibration feeds. It is available for either manual or automatic interlocked-cycle operation, is adaptable to multiple-head operations, and will perform two operations per hole when fitted with an index-table.

The machine illustrated is equipped with two standard model 19-150 hydraulic-drill units which provide a capacity for drilling holes 5/16 inch in diameter in mild steel and tapping 3/8 inch holes. The maximum stroke is 1 1/2 inches, the spindle-speed range 300 to 10,000 rpm, and the feed range 0 to 70 inches per minute. The rapid-approach rate is 350 inches per minute and the

rapid-return rate 300 inches per minute.

These special double-end machines are available completely assembled or as separate components for assembly by the user. The base, which is equipped with a coolant tank and pump, chip tank and coolant trough, is 40 inches high, 22 inches wide, and 65 inches long. It is a ruggedly constructed steel weldment and requires no special installation.

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Gigantic Automatic Hydraulic Scrap Shear

A giant-size scrap shear designed and built by the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill., is hydraulically operated and equipped with a hopper and charging box to provide for continuous operation. The operating mechanism is totally enclosed, as shown by the phantom lines in the illustration, and is weatherproofed to permit outdoor operation. The Hydra-Shear, as this huge machine is called, is a self-contained unit requiring only electrical connection to place it in operation. The Consolidated Mill Supply Co., Chicago, Ill., has been appointed exclusive distributor for the machine.

Towering to a height of 2 1/2 stories, this unit weighs about 300,000 pounds and is ruggedly constructed to take the punishment of full-time outdoor operation, yet handle precision press work. The heavy-duty alloy shear-blades are easily adjusted to compensate for wear, and will cut all types of heterogeneous scrap steel to meet specifications of consuming mills and foundries. It is claimed by the manufacturer that the new machine, with one operator, can do the work of five or six conventional, alligator type shears requiring fifteen to eighteen operators. In addition, the new shear virtually eliminates the need for torch-men in the yard. It will develop 600 tons pressure and cut 30 tons of scrap per hour.

The feed hopper, 22 feet by 6 feet by 1 foot 10 inches deep, is loaded with scrap and tilted by hydraulic cylinders to dump the scrap into a charging box. A hydraulic ram operates through the charging box, pushing the scrap into the shear position. The stroke of the charging ram is adjustable in 6-inch increments from 6 to 48 inches. This feature means that scrap can be cut into the desired uniform lengths.

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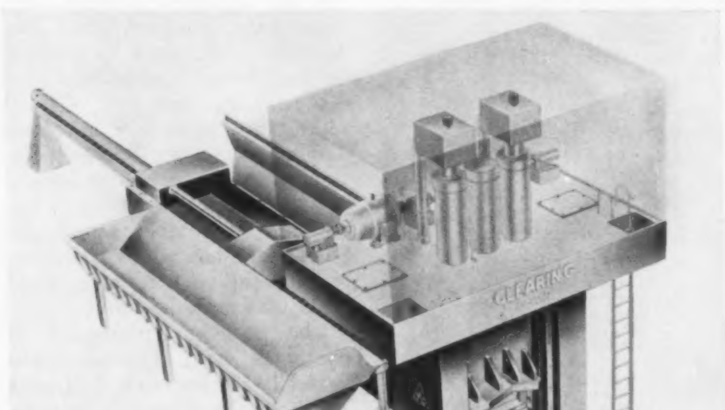
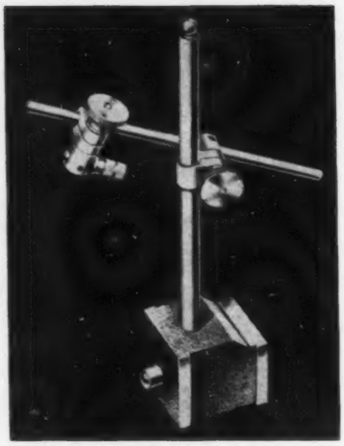


Automatic scrap shear of gigantic size built by Clearing Machine Corporation



Magnetic-base indicator holder introduced by the L. S. Starrett Co.

Starrett Magnetic-Base Indicator Holder

A new model of the Starrett No. 657 magnetic-base indicator holder introduced by the L. S. Starrett Co., Athol, Mass., holds all types of dial indicators including rack and pinion models with lug type backs as well as the Starrett No. 196 and No. 711 "Last Word" indicators. The new indicator holder shown, designated No. 657AA, is furnished with the Starrett No. 657 magnetic base which features a powerful permanent magnet and a large diameter push-button for turning the magnetic force on or off. The push-button permits placing the indicator holder with one hand while the other is free to position the indicator.

In addition to the magnetic base, the model 657AA includes a 3/8-inch diameter upright post; a sleeve which holds the stem of a No. 196 indicator and can be positioned at any height on the upright post; a sleeve which can be positioned along the length of the rod; and an indicator attachment which holds Nos. 81, 25, 655, or 656 lug-back indicators. No. 711 indicators are mounted directly on the 1/4-inch diameter rod by means of the body clamp furnished with these indicators as regular equipment.

All working surfaces of the base are precision ground. Non-working surfaces have a fine wrinkle finish. A V-step across the top of

the base adapts it for mounting on horizontal or vertical arbors. A tapped hole on one side provides a second mounting position for the upright post. Dimensions of the base are: 1 15/16 inches high by 1 5/8 by 1 7/8 inches.

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Cleereman Layout Drilling Machine

The adaptability and range of the layout drilling machine made by the Cleereman Machine Tool Corporation, Chicago, Ill., for the jigless manufacture of medium and small production parts has been greatly extended by the provision of job rods. The locating, drilling, and boring of parts is said to be accomplished much easier through the use of the job rods.

By mounting a job rod on the table of the layout drilling machine for controlling longitudinal positioning, and another job rod on the carriage to control transverse positioning, any work-piece, regardless of the complex pattern of holes, can be produced rapidly and efficiently without the use of jigs or fixtures. An individual set of rods is provided for each production piece to serve as an accurate and permanent master for duplicating the job without delay at any future time.

Each job rod has holes 1/4 inch in diameter bored at locations which correspond with the distances between the hole centers of the work-piece. Each hole in the work-piece is located by placing a stop-pin in each job rod. As a hole is finished, the pin is moved to the next hole in the rod to locate the table for the next drilling operation.

Layout drilling machines for job-rod use are equipped with micrometer dials and scales, and three methods for table and carriage movements are available. Automatic positioning controls hole spacing by means of a single push-button as illustrated. This button provides simultaneous longitudinal- and transverse-power rapid traverse to a point close to the final position where slow-power traverse is automatically engaged and a ten-second creep cycle brings the table to the final position. The alternate power-rapid traverse movement stops close to the final position and finish adjustment is made with the fine-feed handwheel. Hand traverse is also available when this method is preferred.

When good commercial tolerances are acceptable, the job rods may be made on the layout drilling machine, but when ultra-precision tolerances are required it is preferable to use a jig borer, although the layout drilling machine is easily equipped with troughs and end measuring rods on the table to provide the required accuracy. When desired, the manufacturer will lay out and jig-bore job rods to user specifications or provide blank rods.

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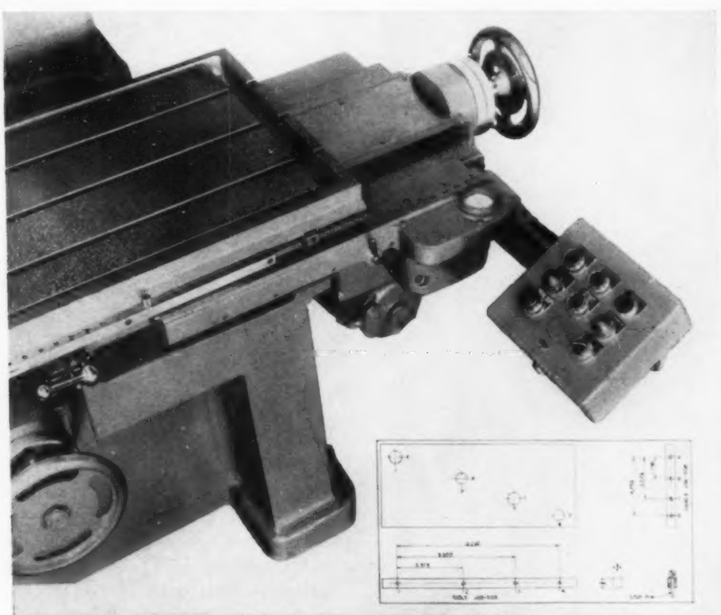
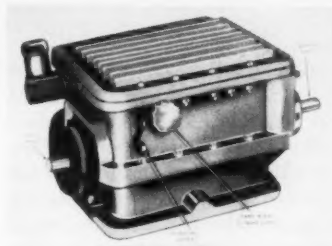


Cleereman layout drilling machine equipped for automatic positioning and insert showing hole job-rod layout



Roberts variable-speed hydraulic speed reducer

Variable-Speed Hydraulic Speed Reducer

The Roberts Electric Co., Chicago, Ill., has brought out a variable-speed hydraulic speed reducer for 1/4- to 1 1/2-hp motors. This speed reducer is designed for instantaneous reversal, giving output speeds in either direction of from 0 to 750 rpm. It is adapted for use on lathe heads, reamer drives, conveyors, printing presses, garden tractors, midget cars, pumps, milling machines, etc.

Reversing is independent of speed control and permits the unit to be used for applications requiring continuous reversing operations. Speed selection is obtained by rotation of a handwheel that gives an infinite number of speeds through the entire available range of the unit. The unit consists of a variable-displacement hydraulic pump that drives a fixed-displacement hydraulic motor with a recommended maximum input speed of 750 rpm. Input rotation is counterclockwise when facing the input shaft. The unit is self-contained in a sealed 2-quart ca-

pacity aluminum oil reservoir with separate controls for speed variation and reversing. Adjustable automatic-relief valve is pre-set at factory for 100 inch-pounds of torque and may be reset up to 180 inch-pounds. Input and output shafts are both 5/8 inch in diameter, with standard keyway. The unit is 11 inches long, 7 1/2 inches high, and weighs 32 pounds.

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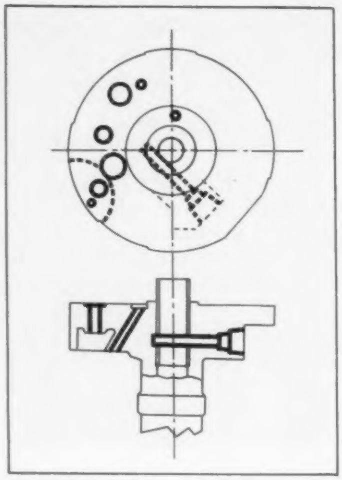

Fig. 2. Simplified view showing in heavy line the operations performed on cast-iron distributor base by machine illustrated in Fig. 1

Special Five-Station Machine for Processing Cast-Iron Distributor Bases

A five-station, multi-spindle vertical machine that performs numerous drilling, tapping, spot-facing, counterboring, and chamfering operations on cast-iron distributor bases has been designed and built at the London, Ontario, Canadian plant of the Ex-Cell-O Corporation, Detroit, Mich. This machine, Fig. 1, is composed of a heavy-duty base on which is centrally mounted an electromechanical indexing-table carrying a five-station, two-compartment fixture. Circularly located on the base and adjacent to the fixture table are three standard hydraulic power units and a tapping head for horizontal and angular operations. The vertical column of the machine carries a multi-spindle drill head mounted on a hydraulically operated slide. The simplified view of the part, Fig. 2, shows in heavy lines the operations performed on the unit, including drilling, tapping, spot-facing, counterboring, and chamfering.

The parts are manually loaded into the right-hand compartment of the fixture. After a complete revolution, during which they enter each of the four work-stations, the parts are unloaded and reloaded into the left-hand compartment. The machine again revolves around the work-stations, after which the processing is complete. The fixture provides for automatic orientation of the work-pieces. Production is at the rate of 150 distributor bases per hour.

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Fig. 1. Ex-Cell-O special five-station machine for processing automotive part

General Electric Speed Variator

A new line of packaged adjustable-spe d drives has been announced by the Direct Current Motor and Generator Department of the General Electric Co., Schenectady, N. Y. These speed variators are designed to require only a minimum of maintenance attention and are available in ratings of 3 through 150 hp and in speed ranges of 8 to 1 and higher. Speed variators are intended for use on continuous processing lines, calender drives, machine tools, crane hoists, metal rolling and blooming mills, paper-processing machinery or wherever adjustable speed for fine control is needed.

A G-E Amplistat regulator with silicon rectifiers is standard equipment on the new line. The regulator provides smooth, timed acceleration and deceleration to pre-set speeds in addition to voltage regulation. The new static excitation system with silicon rectifier has no moving parts and requires no warm-up period.

The motor-generator set is of

two-unit, four-bearing design. G-E Tri-Clad 55 alternating-current motor and direct-current generator are connected by flexible coupling. Standardized-power unit-control devices are unit-mounted and front-connected. Recessed wiring troughs eliminate wiring harness and improve accessibility. Incoming power and control connections are simplified by terminal boards. The units are smaller and lighter than preceding designs and can be installed end-to-end, and end-to-wall, or within six inches of back wall.

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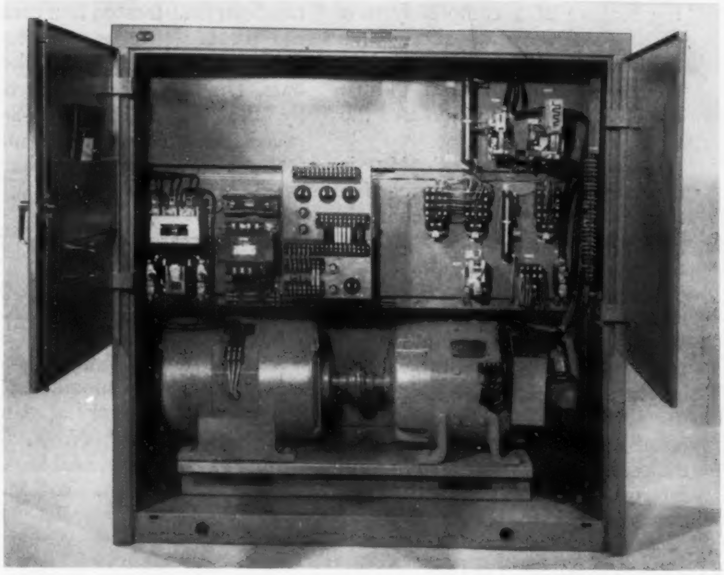


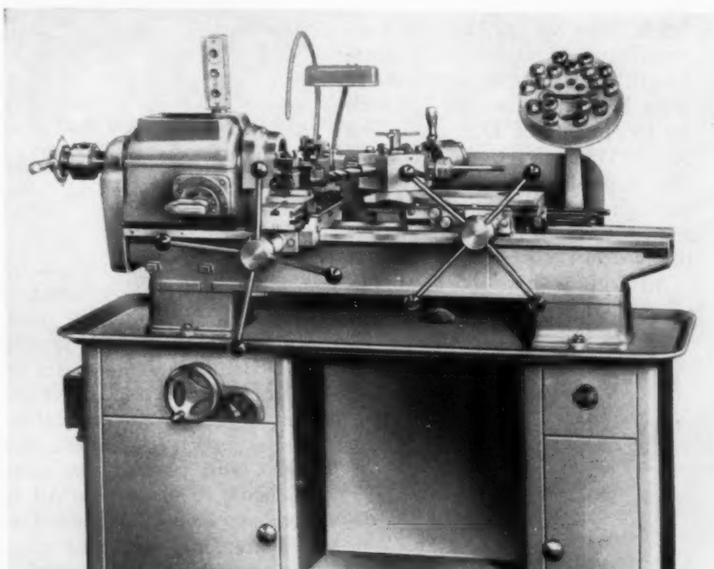
Front view of General Electric speed variator showing doors open and ventilating panel removed

Delta Hand Screw Machine for Economical Handling of Short-Run Work

A low-cost, versatile hand screw machine designed to provide all the production advantages of the turret lathe without necessitating the higher outlay for often unneeded and expensive extra equipment has been introduced by the Rockwell Mfg. Co.'s Delta Power Tool Division, Pittsburgh, Pa. This machine is designed primarily to cut costs on short-production runs of 50, 500, or 1000 pieces. It combines the time and cost-saving features of rapid chucking and multiple tooling with the advantages of low initial investment, low maintenance costs and power consumption, minimum setup and changeover time, and small space requirements.

The machine is said to be ideal for repetitive manufacturing of a wide variety of parts ranging from simple pieces such as washers and shafts to intricate parts used in the electronics and aircraft industries or any operation involving the production of a limited number of precision parts. Through the use of tooling such as form and cut-off tools; die-heads; box-turners; drills and taps; and knurling, threading and boring tools, as many as fifty parts can be machined in the time it would take to produce one part on an engine lathe with conventional equipment.

The new machine has a bed turret with six stations for up to six operations. The turret is moved quickly from one operation to the next with a simple turn of the pilot wheel, and the work-piece is chucked in a fraction of a second by a touch on a conveniently located lever. An important advantage also claimed for the new machine is a unique pilot-wheel feed which is the outstand-



Delta hand screw machine introduced by Rockwell Mfg. Co.

ing feature of a completely new double-toolpost cross-slide. This feature combines a rapid-slide movement with a full 8-inch travel which greatly increases the work capacity.

Universal tool positioning is made possible by an exclusive new feature. T-slots in the toolpost pad and slide make possible transverse and longitudinal adjustment without disturbing the saddle on the bed. The hardened steel toolposts have left and right tool positions, sliding-wedge height adjustment that eliminates the need for shimming, and adjustable tool-kit stops designed so that either angular or straight tool settings can be maintained when a tool bit is sharpened or replaced.

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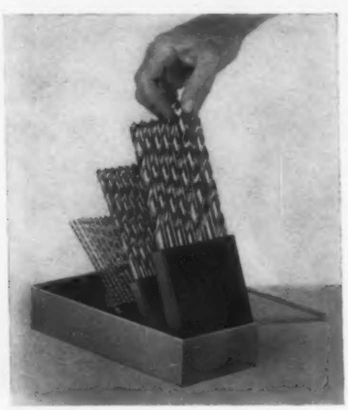
"Ground-from-the-Solid" Drills

Three new taper length drill sets—which include length drills in fractional, wire, and letter sizes packaged in convenient folding metal index cases—are now being offered as standard stock items by the Ace Drill Corporation, Adrian, Mich. The No. 29 Halfpak fractional-size set consists of 29 taper-length drills ranging in diameter from 1/16 inch through 1/2 inch by increments of 1/16 inch. The No. 60 Wirepak set contains wire-size taper-length drills from 1 through 60 inclusive, while letter sizes A through Z are included in the No. 26 Letterpak set.

All drills in these sets are made of selected high-speed steel which has been heat-treated in a continuous furnace to give extra tough, uniformly hardened mill-length bars. The drills are manufactured by the "Ground-from-the-Solid" process originated by the manufacturer to give them sharper, keener cutting edges and longer life.



Ace Ground-from-the-Solid drills

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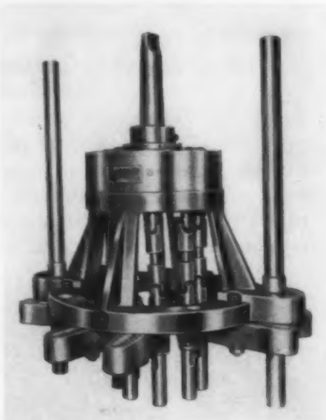
Errington Universal-Joint Drilling Head

A multi-spindle universal-joint drilling head is announced by Errington Mechanical Laboratory, Inc., Staten Island, N. Y. This drilling head is available with spindles having up to No. 3 Morse taper sockets. It has a maximum drilling pattern of 14 inches without extension spindles and is available with up to twelve spindles. Heads with a greater number of spindles and larger diameter capacities are available on special order. The case, cover, frame, and locator arm castings are made of aluminum. All spindles have integral machined gears and are hardened and ground. The drive-gear has heavy-duty grooved ball thrust bearings top and bottom of gear and heavy-duty roller bearings top and bottom. All drill spindles have double needle bearings in locator arm and heavy-duty grooved ball thrust bearings. Spindles in head have Johnson bronze bearings.



Multiple-spindle drilling head made by Errington Mechanical Laboratory, Inc.

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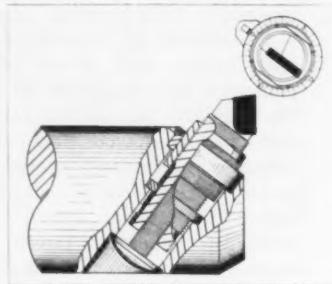

Calibore precision cutting-tool unit

Calibore Precision Cutting-Tool Units

The Beaver Tool and Engineering Corp., Gaylord, Mich., has announced a line of precision cutting-tool units called Calibore and designed for a wide range of precision boring, turning, and other metal-cutting operations. These units are easily adapted to multiple or cluster bar installations for machining several related surfaces at the same time. They are available in twenty-six sizes for boring holes from 3/4 inch in diameter upward. The units are made for 53-degree angle or 90-degree perpendicular mounting in boring bars and have an extremely fine increment of adjustment. There is direct reading to 0.0005 inch on bore diameters with each graduation of the Calibore mounting dial. The rigidity and support of the tool carrier in all positions is accomplished by the telescoping action of the differential adjusting sleeve. Carbide tool-carrier tips for cutting steel or carbide for cutting cast iron and non-ferrous materials, as well as high-speed tool carriers, are available.

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Two-Spindle Nut-Setter

A two-spindle nut-setter which feeds and runs down wing-nuts automatically, utilizing air-driven nut-setters with nut-tension control, has been designed and built by the Thor Power Tool Co., Chicago, Ill. This tool is designed to fasten together two parts at the rate of 1200 assemblies an hour. Nut tightness and screwdriver torque are controlled by a Thor air regulator.

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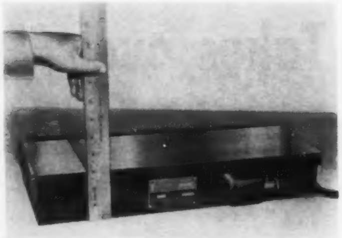

Magnetic Chuck of Low Height Design

Electromagnetic chuck only 2 7/8 inches high announced by Hanchett Magna-Lock Corporation, Big Rapids, Mich. This new chuck, designated Model CL, has maximum working height under the grinding wheel. It is available in seven sizes, ranging from 5 by 10 inches up to 10 by 16 inches. The chuck has a fine pole laminated top, is of steel welded precision construction, and is moisture- and shock-proof. Holding power is uniformly distributed to the extreme edges of the faceplate. This chuck is furnished complete with rectifier and built-in switch.

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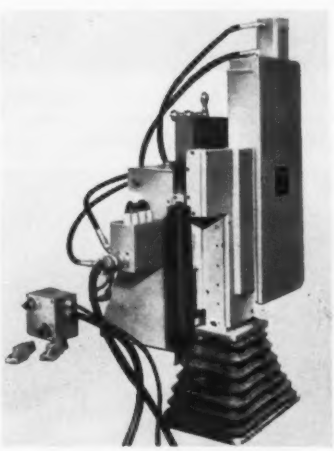
Wheel Dresser for Cylindrical Grinder

Hydraulic contour wheel dresser Model 86, available from Hoglund Engineering & Mfg. Co., Berkeley Heights, N. J., for use on cylindrical grinders. The dressing diamonds are optically set in the microscope fixture so that no dresser adjustments are necessary when changing diamonds. This dresser will handle profile widths up to 6 inches and depths up to 3 1/2 inches. It is hydraulically actuated and can be tied directly into the grinding cycle for fully automatic operation. Where applicable, uniform peripheral diamond dressing speed is possible.



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Ross Silver Model Valve

Silver model valve, designed to comply with JIC standards, introduced by Ross Operating Valve Co., Detroit, Mich. This valve brings to six the number of Skyline pilot heads which can be mounted interchangeably on the

seven Ross Skyline valve bodies. Tests indicate that this spool solenoid pilot valve has a long life of 25,000,000 cycles. The Ross Skyline valve bodies, providing modular construction for flexibility in applications, include: straight way, normally open and normally closed; three-way open and closed (all in the in-line series); and three-way, normally open and normally closed; and four-way (all in the base-mounted series).

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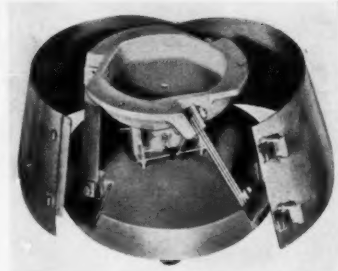
Vibratory Feeder Unit

New size vibratory feeder unit recently added to the regular line of small parts feeding equipment made by Vibratory Feeder Co., Erie, Pa. This new base type unit, built and powered specifically to handle 24-inch bowls, incorporates the three-spring suspension principle. The springs are arranged in a near vertical position for greater balance and increased steady flow. The demand for bowls from 18 to 30 inches in diameter motivated



development of this base model, identified as No. 20. Feeder bowls of a new design are also available for this vibrator. The base unit is 20 inches in diameter, 13 1/4 inches high, and is available for counter-clockwise as well as clockwise movement.

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Fenway Portable Nibbler

Improved Model HN portable nibbler produced by Fenway Machine Co., Willow Grove, Pa. Design features incorporated in this portable nibbler make it suitable for cutting titanium, stainless steel, and all types of non-ferrous metals, without distortion on either side of the cut and leaving the edge ready for fabricating. The tool cuts up to 55 inches per minute, with a minimum radius of 6 inches. For a shorter 3-inch radius, a special die-holder is available for use on 12-gage stainless and lighter metal. The tool, weighing 13 pounds, and measuring only 13 inches in length, operates on alternating or direct 115-volt, 60-cycle current.

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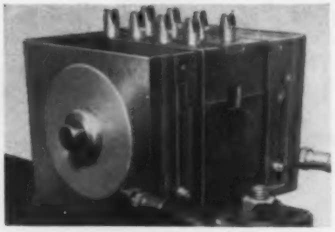
(This section continued on page 230)



Multiple Milling Fixture

Air-operated, hydraulic multiple milling fixture recently developed by Multi Engineering Co., Stone Park, Ill. With this fixture as many as eight parts can be milled at one time. Split bushing type collets accommodate round, hex, square, or irregular shapes. Self-equalizing jaw inserts automatically compensate for variations in diameters of the work-pieces. Thus, equal pressure is applied on each collet, providing solid lock-up on each part, regardless of its diameter. Diameters can vary plus or minus 0.010 inch in any size from 1 inch down to 1/16 inch. The changing of all eight collets from one job to another takes less than five minutes. Using an air-line pressure of 100 psi the booster delivers a total holding force of up to 8400 lbs., equally distributed over the eight stations. Adjustable stops provide accurate control over depth of cut.

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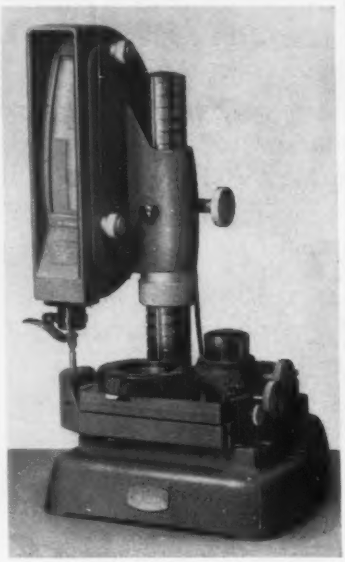
Bearings that Require No Lubrication

Bearings of a new dry bearing material developed for applications where lubrication is a problem by the Crane Packing Co., Morton Grove, Ill. This composite material, known as Chemloy, is especially recommended for both sliding and rotating dry bearing services at temperatures up to 500 degrees F. The properties of this material make it especially well adapted for use with solvents such as acetone, as well as practically all types of corrosives. It is also excellent for applications subject to impact, and particularly in mechanical linkage assemblies where constant vertical and horizontal impact occurs. Chemloy has a static or kinetic coefficient of friction against polished steel of only 0.04 and will withstand speeds up to 1000 feet per minute and loads to 100 psi.

Circle Item 146 on postcard, page 233



Leitz Internal Comparator Gage

Leitz internal "Tolerator" gage placed on the market by Opto-Metric Tools, Inc., New York City. To obtain a true inside diameter measurement, the straight-line 2-point contact method is employed. One measuring jaw is fixed in position and serves for locating the work. The other jaw is a 1 to 1 ratio bellcrank lever, which is connected to the gaging head. The table on which the work is staged floats on balls and thus becomes self-locating. For determining straightness of bore, taper, or bellmouth, the table can be moved vertically by rack and pinion. The gaging head is the

(This section continued on page 238)

TO "TENTHS" IN SECONDS

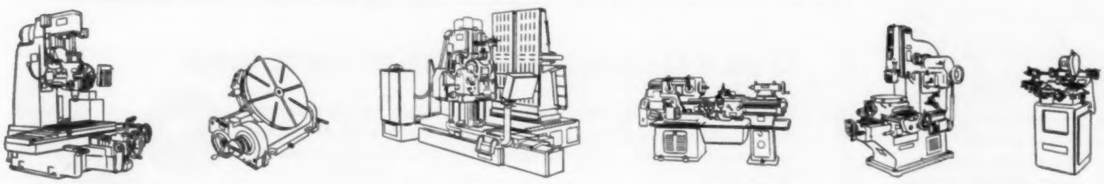
. . . *and no mistakes!*

WITH NEW PRATT & WHITNEY NUMERICAL CONTROL

Operating under Numerical Control, this P&W Precision Hole Grinder is positioned and re-positioned – accurate to .0001" – in an average of only 14 seconds! And since settings are controlled by a punched tape, the chance of work spoilage through operator error in reading blueprint data or setting dials is eliminated. The operator is free to concentrate his attention on work quality.

Applied to Pratt & Whitney Jig Borers, Precision Hole Grinders, Rotary Tables and special machines, Numerical Control not only speeds up toolroom operations, but also makes the high precision of these machines available for efficient short- or long-run production work. In this type work, time savings up to 40% over manual operation are realized. Compare the performance of your present manually-controlled machines with the new standards of speed, accuracy and economy being established by numerically-controlled P&W equipment. If they don't measure up, you are missing important opportunities for improved work quality, larger savings and greater profits.

Write now for complete information.
Pratt & Whitney Company, Incorporated,
12 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

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MACHINE TOOLS · GAGES · CUTTING TOOLS

RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Fastener coatings

Salt spray testing of various metallic coatings used on fasteners doesn't always give a true picture. In actual service, accelerated test results are not always borne out.

Reason: The tests favor the coatings which can endure continuous moisture and salt atmospheres, whereas some do better under the normal intermittent dry and wet conditions of weathering.

Experience has developed a "scale" of suitability of various coatings for fastener protection.

FOR RUST PROTECTION

Hot galvanizing offers greatest endurance under most conditions. It falls short on highly stressed fasteners.

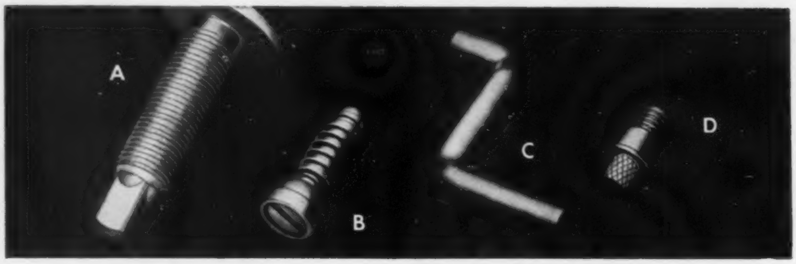
Electrodeposited zinc is next most practical — providing good appearance, controlled tolerance at threads, and ability to take high bolt tensions.

Cadmium plate stands out where salt atmospheres predominate. Not suitable for contact with edibles, it is ruled out for many appliances.

For general applications, the rust prevention of black oxide coatings proves satisfactory. Phosphate coatings, too, offer some degree of protection, but not under severe conditions.

Chromium, plated over copper, should be considered more for its appearance on fasteners rather than protection.

Cold heading creates quality parts the low cost way



No value analysis of product components is really complete without exploring what cold heading machines can do to cut costs. Some examples:

A. ELIMINATE EXTRA OPERATIONS. Leveling screw, formerly made by riveting flat disc to set screw, now emerges as a stronger, single piece from a cold header.

B. ONE PIECE BETTER THAN TWO. Cold headed hose clamp screw has integral flange which, after head is slotted, is forced up to form screwdriver shield. Before, piece was in two parts . . . with screw made on screw machine, and the shield a stamping fitted around head during assembly.

C. FASTER THAN FORGING. Shifter lever is bent into double "L" automatically in bolt header . . . replacing 2-stage forging operation. The header does it at high speed from continuous rod.

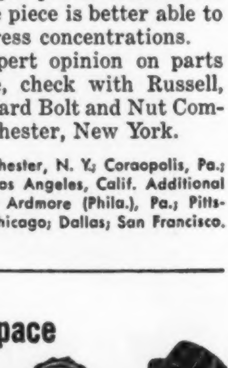
D. METAL FLOWS TO SHAPE—NO WASTE. No longer cut on screw machine, insert screw for plastic parts costs 40% less. Cold header uses just the amount of metal required. The threading and knurling, too, are done automatically at high speed.

Metal forced to cold flow into shape results not only in savings but also in stronger parts. With uncut flow lines, the piece is better able to withstand stress concentrations.

For an expert opinion on parts you now use, check with Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

12-point fasteners cut wrench clearance space



Double hex RB&W bolts and nuts measure smaller across their points than single hex fasteners. Used with an *external* socket wrench, they permit optimum driving torque to be applied.

Thus, while permitting design of more compact assemblies, these fasteners also assure proper preloading for stronger connections.

Available with plain flange, or SPIN-LOCK design which incorporates teeth that embed upon tightening and resist loosening under vibration or temperature changes.

For more information fill in page number on Inquiry Card, on page 233

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

INDUSTRIAL TRUCKS—Industrial Truck Association, Washington, D. C. 96-page publication entitled "The Handbook of Powered Industrial Trucks," resulting from nearly three years' efforts. The publication has been designed to answer the needs of purchasing, operating, production, maintenance, and material-handling personnel in all industries. It contains case studies showing specific industrial-truck applications, as well as nearly 200 illustrations of various truck types, attachments, containers, and load-carrying devices. In addition numerous engineering tables, graphs, and charts are used to present practical truck-operating data 1

CUTTER AND ACCESSORIES—Brown & Sharpe Mfg. Co., Providence, R. I. 96-page illustrated catalogue 37C, covering the company's entire line of metal-cutting tools, as well as arbors, adapters, collets, vises, index-plates, work-driving dogs, taper mandrels, expansion bushings, and spring chucks. Shown for the first time is a line of ball end-mills, both double-end and extended lengths; and an additional line of shell end-mill arbors. The selection of two-, three-, and four-lip end-mills and of side-milling and corner-rounding cutters has been greatly expanded. 2

HARD-FACING ALLOYS—Haynes Stellite Co., Division of Union Carbide Corporation, New York City. 8-page bulletin entitled "Haynes Hard-Facing Alloys—Bare Rods, Powder, Crushed Particles," describing chemical composition, some properties, typical applications, and application procedures for eleven Haynes alloys. These include four iron-base alloys, three cobalt-base alloys, Haystellite cast tungsten-carbide, and three nickel-base alloys. 3

ADHESIVE BONDING MACHINES—Modern Industrial Engineering Co., Detroit, Mich. 6-page bulletin CB-1, describing the company's line of new machines (from two-station stationary models to thirty-station rotary models) for assembling parts of various materials by adhesive bonding. The machines feature positive control over all bonding factors. Custom-tailored fixtures adapt them to a wide range of applications. 4

PRECISION TOOLS—R and L Tools, Inc., Philadelphia, Pa. 32-page catalogue containing listings and prices of the complete line of the company's tools, including seven new tools and attachments. These consist of an off-center drilling attachment; holder, cross-slide knurling tool, and tool-slide knurling tool for multi-spindle automatics; a combination swing tool; and a swing tool attachment and a knurling attachment for turning tools. 5

INDUSTRIAL FASTENERS — Standard Pressed Steel Co., Jenkintown, Pa. 4-page bulletin reviewing the complete line of SPS industrial fasteners, including Umbrako socket screw products, Flexloc self-locking nuts, Sel-Lok spring pins, and Hallowell steel collars. The pamphlet gives range of sizes, materials, finish and other specifications for socket head cap- and set-screws, shoulder screws,

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both regular height and thin self-locking nuts, clinch nuts, dowel pins, spring pins, and collars. Included are microsize fasteners—cap- and set-screws, lock-nuts, and clinch nuts. **6**

FOREIGN LIAISON—Kurt Orban Co., Inc., Jersey City, N. J. 14-page booklet digesting the broad scope of the company's operations and telling how its approach to importing not only opens up wide sources of supply to American and Canadian industry but eliminates many problems that may have caused domestic companies to hesitate to use imported products. **7**

PICKING TAPS—Detroit Tap & Tool Co., Warren, Mich. 20-page booklet entitled "What Do You Mean 'Specific' Taps?" telling how to get long tap life and better performance with tapping different materials such as tough steels, cast iron, aluminum, zinc, brass, and plastics. The booklet is illustrated with typical applications for each material. **8**

GRINDING—Carborundum Company, Niagara Falls, N. Y. 24-page brochure entitled "Tool Room Grinding of Alloy, High-Speed, and Die Steels," designed to be a single source book on grinding for toolroom men. Covering twenty-two areas in the field, it includes quick reference charts on grinding recommendations and grindability of steels in the toolroom. . . **9**

SPRING PIN APPLICATIONS—Standard Pressed Steel Co., Jenkintown, Pa. 4-page folder describing applications for Sel-Lok spring pins in a wide variety of product assemblies. The spring pins—slotted, tubular pins that lock by spring action when driven into standard commercial holes—eliminate the need for tapping, reaming, peening, and milling operations. They can be quickly installed and removed, and can be used again and again without impairing its holding power. Information on machines, materials, finish, hardness, strength, and other specifications is included in tables and drawings. **10**

DISTRIBUTION SYSTEM—Bijur Lubricating Corporation, Rochelle Park, N. J. 12-page bulletin describing the company's lubricator pumps and Meter-Units for the distribution and metering of oil films. The pump feeds a definite volume of oil into the distribution system where Meter-Units apportion the oil feed to the individual bearings. **11**

PRECISION INSTRUMENT PARTS—PIC Design Corporation, subsidiary of Benrus Co., Inc., East Rockaway, N. Y. 64-page supplementary catalogue 13 to be used with main catalogue, containing the latest PIC development in 24-, 32-, 80-, and 200-pitch gears, precision 2C gears with PIC True Blue gear tapes and other precision instrument parts and components. **12**

STAINLESS FASTENERS—Allmetal Screw Products Co., Inc., Garden City, N. Y. 52-page stainless fastener stock list and data book including illustrations, thread and design specifications, and availability in a variety of corrosion-resistant metals of forty basic fastening devices. Engineering data relating to composition, properties, and applications are reviewed. **13**

TUMBLING ABRASIVE—Simonds Abrasive Co., Philadelphia, Pa. 4-page catalogue Form ESA-236, describing Borolon tumbling abrasive for barrel finishing. This material is aluminum-oxide abrasive in chips and screen grain sizes for a wide range of use. New size standards for chips are also described. **14**

COLD FRICTION SAW—United Engineering & Foundry Co., Wilmington, Del. 4-page bulletin featuring the company's cold friction saw designed and built for production friction cutting. This tool comes in four different sizes—heavy weight, hydraulic transverse, efficient blade design, and high-pressure coolant. **15**

SERVICE MANUAL—Standard Gage Co., Inc., Poughkeepsie, N. Y. 28-page bulletin entitled "Dial Indicator Service Manual and Parts List," aiming at those users of dial indicators who prefer to do their own servicing. Included are exploded views to enable correct identification of parts. **16**

CARBIDE TECHNICAL MANUAL—Firth Sterling, Inc., Pittsburgh, Pa. 20-page booklet describing the manufacture and physical properties of tungsten-carbide, Firthite grade selection and application, the use of single-point tools, and recommended Firthite cutting speeds. . . . **17**

ROTARY SYNCHRONIZING SWITCH—E. W. Bliss Co., Canton, Ohio. 4-page bulletin 33-A, describing a precise mechanical limiting switch which controls the stopping, starting, interlocking, time motion, sequence, and recycling of machine tools, as well as mechanical press auxiliary equipment. **18**

NUMERICAL CONTROL OF PRODUCTION PARTS — New Method Steel Stamps, Inc., Detroit, Mich. 2-page sheet SM57, describing numerical control of production parts in automated production-assembly lines through the use of an automatic marking machine. **19**

FILES—Heller Tool Co., subsidiary of Simonds Saw & Steel Co., Newcomerstown, Ohio. 16-page bulletin describing the company's wavy-teeth files and how to choose a file. This is a complete file

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reference booklet, including a file dictionary and recommended uses. 20

MECHANICAL RUBBER—Henry Engineering Co., Moline, Ill. 24-page booklet describing bonding of molded, mechanical rubber to metal (including aluminum), compounding of rubber for tailor-made jobs, and uses of metals when cushioned with rubber where metal on metal cannot be used. 21

POP RIVETS—United Shoe Machinery Corporation, West Medway, Mass. 4-page folder covering selection and use data on the company's Pop rivets. Discussions of costs, clinching properties and range of grip, domed head, and countersunk head rivets are included. 22

INDUSTRIAL MOTION PICTURES—United States Steel Corporation, Pittsburgh, Pa. Catalogue describing educational and entertaining motion pictures. This new edition of the catalogue includes listings of seven new films, several of the older ones having been deleted. 23

CASTING PRODUCTION—General Electric Co., Schenectady, N. Y. Publication GIZ-795, describing mass-production techniques and advantages of the Permold process of producing quality-engineered, controlled Brinell range, high-tensile strength castings. 24

AUTOMATIC CUTTING-OFF MACHINES—Modern Machine Tool Co., Jackson, Mich. 4-page folder describing the company's cutting-off machines and automatic loaders, as well as hot spinning machines and the safety drill table. 25

ELECTRIC BRAKES AND CLUTCHES—Warner Electric Brake Clutch Co., Beloit, Wis. Catalogue WEB 6992, giving facts about electric brakes, clutches, and controls for miniature mechanisms or high-torque machine drives. 26

NON-FERROUS METALS — American Brass Co., Waterbury, Conn. 60-page copper and brass warehouse stock list, including all items and sizes carried in stock for immediate shipment from the company's warehouses. 27

SPEED COLLET CHUCKS — Hardinge Brothers, Inc., Elmira, N. Y. 12-page bulletin 8B, describing the company's speed collet chucks, including recommended uses, and all types of toolroom lathes, engine lathes, and grinders. 28

CLOSE CENTER DRILLING—ConRoy Corporation, Dayton, Ohio. Leaflet DH-957, describing the company's close-center drill head and automatic index-table for producing any combination of patterns of holes on a close center with high accuracy. 29

SPEED REDUCERS—Cone-Drive Gears, Division Michigan Tool Co., Detroit, Mich. 20-page catalogue CD-230, covering 160 standard styles and sizes of double-reduction speed reducers in ratios ranging from 75:1 to 4900:1. 30

CLUTCH CONVERSION—Minster Machine Co., Minster, Ohio. 16-page folder CC57, discussing the features of the company's air-friction clutch and brake for reconditioning and modernizing existing mechanical presses. 31

INDUSTRIAL MACHINERY—Lake Erie Machinery Corporation, Buffalo, N. Y. 16-page bulletin 157, describing the company's facilities, both engineering and production, for the manufacture of special industrial machinery. 32

MACHINE TOOLS—Jones & Lamson Machine Co., Springfield, Vt. 22-page general catalogue 57,, Form 5713, including information about the company's complete line of products. 33

MOTOR CONTROL—Allis-Chalmers Mfg. Co., Milwaukee, Wis. 8-page bulletin 14B8507, covering the company's front-access, high-voltage starters Type (H) for 2300- to 5000-volt motors. 34

DRILLING MACHINES — Buffalo Forge Co., Buffalo, N. Y 8-page bulletin 4024, describing the company's new series No. 15 drills. Major improvements are discussed, and there is a complete list of available models. 35

QUICK-CHANGE TOOLS—Beaver Tool & Engineering Corporation, Gaylord, Mich. 58-page booklet describing the company's quick-change tools, accessories, applications, and engineering information. .36

MILLING CUTTERS—Goddard & Goddard Co., Detroit, Mich. 32-page publication describing in detail the company's solid, high-speed steel milling cutters. 37

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SPECIALIZED TOOLS—Walton Co., Hartford, Conn. Catalogue folder Form 1255, describing the company's tap extractors, and other guaranteed specialized tools. **38**

VERTICAL MILLING MACHINE—Famco Machine Co., Kenosha, Wis. 12-page catalogue illustrating and describing the company's 1- and 1-hp vertical mills. **39**

DIES—Firth Sterling Inc., Pittsburgh, Pa. 12-page catalogue FDM-57, covering the company's Firthaloy dies and machinery and Diecarb perforators. **40**

HYDRAULIC PRESSES AND EYE BENDER—Williams-White & Co., Moline, Ill. 8-page bulletin Form 76, describing the company's line of hydraulic presses. Also, 2-page catalogue Form 75, with specifications of the mechanical eye-bender. **41**

ELECTRIC DRILLS—Thor Power Tool Co., Chicago, Ill. 4-page folder JE-2263, featuring the company's reversible, heavy-duty, electric drills. Included are specifications of "EL" and "EJ" electric-drill series, screwdriver-nutsetters, and impact wrenches. **42**

ALLOYS—Wellman Bronze & Aluminum Co., Cleveland, Ohio. 22-page catalogue No. 57, listing the physical properties and conforming specifications for magnesium and aluminum alloys. Listings include alloys for sand castings, permanent-mold and rare-earth alloys. **43**

DIE SET CATALOGUE—Die Supply Division, E. W. Bliss Co., Cleveland, Ohio. 8-page catalogue 70-A, Section 3, describing precision guide pins, shoulder guide pins and bushings, and cam guide pins and bushings, including specifications and list price for each. **44**

HAND SCREW MACHINE—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. Folder AD-1101, describing the company's hand screw machine designed for repetitive manufacturing of a wide variety of parts. **45**

OPTICAL PICKUP ATTACHMENT—Wales-Strippit Co., a unit of Houdaille Industries, Inc., Akron, N. Y. 2-page catalogue, describing the Dupl-O-Scope for punching templates direct from drawing or printed master circuits. **46**

MICROMETER—Brown & Sharpe Mfg. Co., Providence, R. I. 4-page bulletin M-54, describing the company's self-aligning, internal, three-point micrometer for measuring bores and holes. **47**

QUICK-CHANGE HOLDERS—Falcon Tool Co., Detroit, Mich. 72-page catalogue giving complete information on Kwiklok quick-change holders with Taper Interchangeable drive. **48**

TAPS, DIES, AND GAGES—Winter Brothers, Inc., Rochester, Mich. 64-page catalogue No. 24, listing the company's complete line of taps, dies, and gages. **49**

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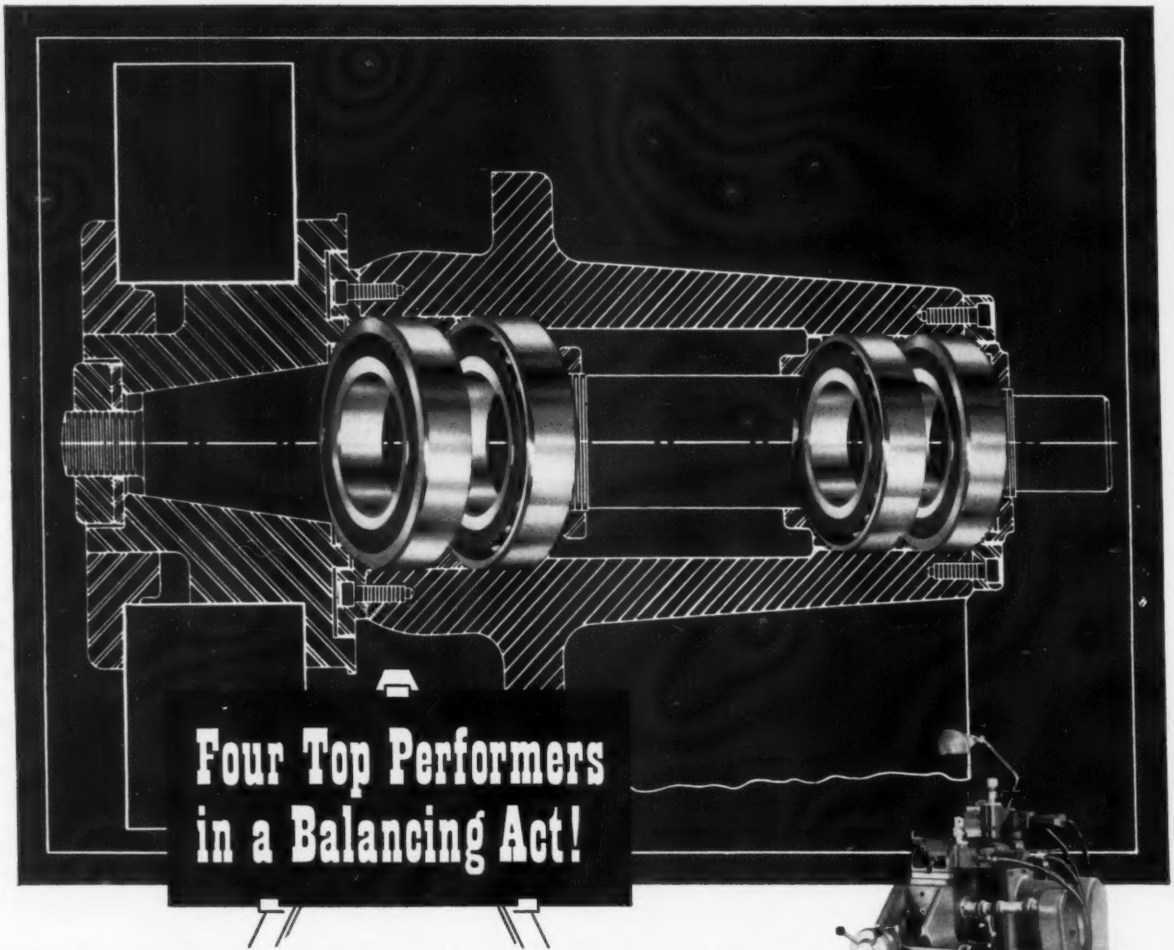


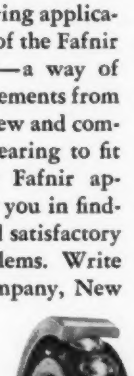
Four Top Performers in a Balancing Act!

To assure true spindle balance, close running accuracy, and vibrationless performance, Royal Master mounts the massive, heat-treated alloy work wheel spindle of its TG-12 centerless grinder on four Fafnir Super Precision Ball Bearings. The spindle assembly itself is mounted directly into the normalized, stress-relieved, close-grained grey iron head stock.

Besides providing proper balance and smooth spindle operation, the Fafnir Preloaded Super Precision Ball Bearings used in the TG-12 eliminate spindle warm-up time—an important feature where the machine is used intermittently. Moreover, relubrication of the bearings is never required. They are lubricated for life when the machine is assembled.

This Royal Master bearing application is a typical example of the Fafnir "attitude and aptitude"—a way of looking at bearing requirements from the designer's point of view and coming up with the right bearing to fit the need. Perhaps the Fafnir approach can be of help to you in finding more economical and satisfactory answers to bearing problems. Write The Fafnir Bearing Company, New Britain, Connecticut.

Royal Master TG-12 Centerless Grinder, Fafnir equipped, is designed for thru-feed, plunge feed, and infeed grinding. It has successfully ground materials ranging from plastics to tungsten carbide. Features include accessibility of both sides of wheel from operating position, for high output and fast checking.



◀ Fafnir preloaded, angular-contact, super-precision ball bearings with composition or bronze retainers are made to highest industry-approved tolerances. Single or duplex bearings like this are used widely on spindle applications.

FAFNIR

BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

For more information fill in page number on Inquiry Card, on page 233

same as used in the Leitz external Tolerator gage. It is a semi-optical mechanism with a 1000 to 1 magnification, in which the reading is visual on an illuminated screen to 0.00005 inch. Two sets of interchangeable jaws provide for gaging bores between 1/4 inch and 3 1/2 inches in diameter and up to 3/4 inch in depth. For setting the gage a master ring or a snap gage built up from gage-blocks can be used. The head may be swung 180 degrees to the rear over a standard anvil whereby it becomes a regular external gage for outside diameter measurements up to 4 inches.

Circle Item 147 on postcard, page 233

Ruthman Small Size Molten Metal Pump

Small vertical centrifugal gusher pump, Model 9025-M, built by the Ruthman Machinery Co., Cincinnati, Ohio, for handling molten metals, such as solder, tin, zinc, lead, etc., at temperatures up to 700 degrees F. A safe operating temperature of the motor is maintained by utilizing three aluminum cooling fans, which rotate simultaneously with the heavy one-piece extended stainless steel shaft. Two generous size precision ball bearings, packed with high-temperature silicone grease, are confined within the motor. The unit is available with either 1/4-hp, 1140-rpm or 3/4-hp, 1725-rpm Class B insulated motor, for capacities up to 7 gallons per minute and heads up to 8 feet.

Circle Item 148 on postcard, page 233

Microsize Screws with Nylok Self-Locking Feature

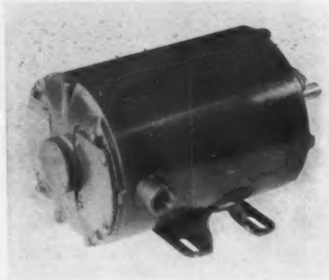
Microsize cap-screws and set-screws (No. 0 to No. 4 sizes) made by Standard Pressed Steel Co., Jenkintown, Pa., with Nylok self-locking feature previously made available on this company's larger-sized Unbrako socket-head cap- and socket set-screws. Availability of the self-locking feature on the tiny fasteners is said to make possible speedier, lower-cost assembly on many applications where vibration causes loosening. The patented Nylok feature is now

available on the complete line of standard and special male threaded fasteners made by the Standard Pressed Steel Co. The Nylok principle is a simple one. A small pellet of tough, resilient nylon is seated in a hole drilled into the threaded portion of the fastener. This pellet is compressed when the fastener is threaded into a tapped hole or nut, exerting an outward pressure which forces the mating threads together more tightly. These fasteners can be removed and reused without reducing the material's resiliency and holding power. Resiliency is unaffected by temperatures from minus 70 to plus 300 degrees F.

Circle Item 149 on postcard, page 233

G-E Fractional-Horsepower Severe-Duty Motor

Form G severe-duty fractional-horsepower motor of new single-phase 60-cycle and three-phase 60/50-cycle motor line introduced



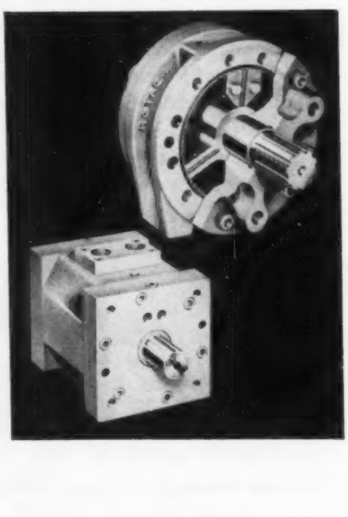
by the General Purpose Motor Department of the General Electric Co., Schenectady, N. Y. The new motors have been especially designed for applications where operating conditions are abnormal. Typical instances in this category include the powering of dairy and food processing equipment where motors are hosed down on a regular basis, and motor installations in the plating and mining industries which do not require the explosionproof feature. New features include: totally enclosed nonventilated construction, base welded to stator shell, stainless-steel shaft, cast-iron end shields, and corrosion-resistant finish on inner and outer surfaces. The motor is available in power ratings of 1/6 through 3/4 hp and in speeds of 3450, 1725, and 1140 rpm.

Circle Item 150 on postcard, page 233

Rotac Actuators

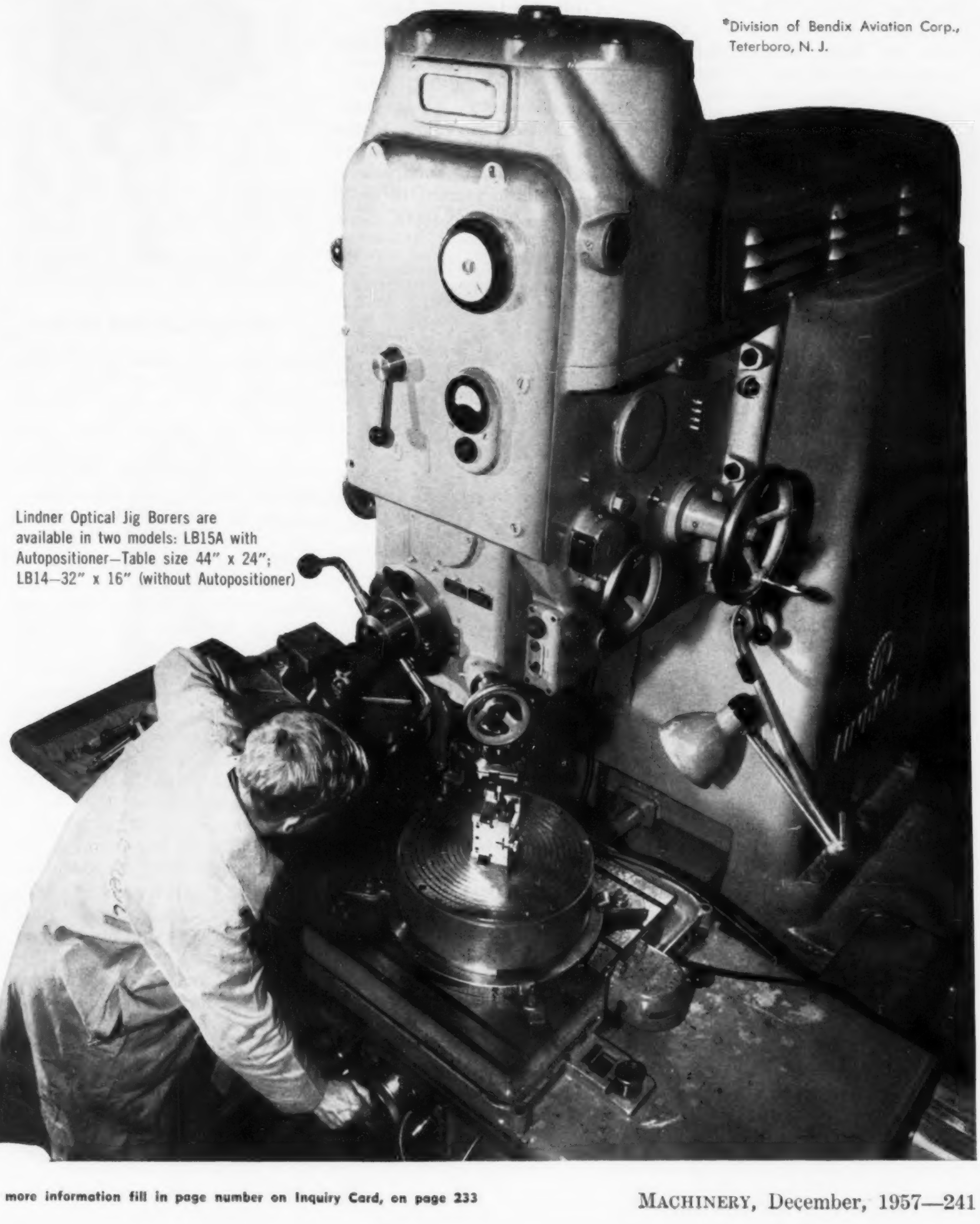
Two models of Rotac actuators manufactured and marketed by the Greenville, Ohio, plant of the Ex-Cell-O Corporation. These

(*This section continued on page 242*)



helps Eclipse-Pioneer* maintain toolroom tolerances in gyro parts production

*Division of Bendix Aviation Corp., Teterboro, N. J.



Lindner Optical Jig Borers are available in two models: LB15A with Autopositioner—Table size 44" x 24"; LB14—32" x 16" (without Autopositioner)

For more information fill in page number on Inquiry Card, on page 233

compact Rotac units can be used for such movements as pulling, pushing, opening, closing, lifting and lowering. The actuators are of simple design and can be operated by oil, water, or air pressure. The cylindrical chamber of a Rotac unit contains a stationary stop and a central shaft on which a vane is fixed. The assembly is enclosed by cylinder end caps, through which the shaft projects. When pressure is applied to either side of the vane, the shaft rotates in the direction in which the pressure is applied. Pressure reversals provide reciprocating movement. Movement is limited to a maximum arc of 280 degrees by the stop within the cylinder. Standard models develop 150 to 300,000 inch-pounds torque at 1000 psi of input pressure. Positive control is achieved by valves.

Circle Item 151 on postcard, page 233

Sheffield Gage Cart

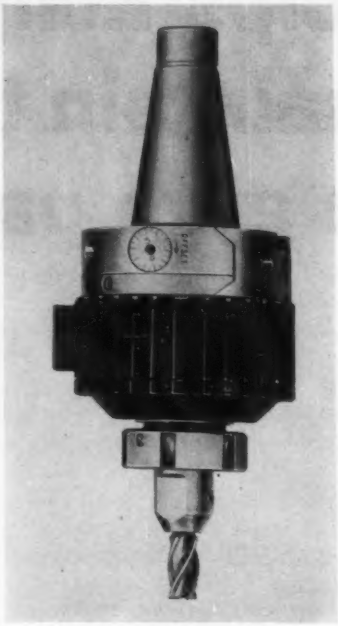
Gage cart developed to house and transport the Precisionaire air gage and related tooling made by the Sheffield Corporation, Dayton, Ohio. This cart has room on its 26 1/2- by 18 1/2-inch top to accommodate both the single-column gage and adjustable tooling suited to a variety of gaging operations. Oversize casters make the cart easy to roll by hand. The cart's top provides supplementary bench space and the bottom compartment can be enlarged by removing the center shelf to install a small compressor and make the cart self-sufficient for gaging in departments or plants where there is no accessible source of compressed air. The four drawers can store adjustable tooling, masters, gage-blocks, air hose, and other items.

Circle Item 152 on postcard, page 233

Pilot Air-Control Valve

Flow-Pilot, air-control valve brought out by Hanna Engineering Works, Chicago, Ill., to eliminate trouble caused by the leakage of pilot air valves due to the settling of dirt, grit, and abrasives around the stems of such valves, especially those located in areas where sand, scale, or metal chips are prevalent. A basic part of this new valve is a small synthetic rubber boot which snaps in place around the valve stem, sealing all critical parts from dirt and abrasives. Aluminum, stainless steel, and molded nylon are used extensively to give the valve longer service life by providing resistance to corrosion. The valve is compact with clean lines which give it an attractive appearance. The basic valve has five optional actuating heads—palm button, ball cam, lever, locking lever, and mechanical link clevis. These are interchangeable in less than 30 seconds by removing two pins. The valve spools can also be replaced in 30 seconds. The valve is built for 150-psi air operation and has 1/4-inch pipe ports.

Circle Item 153 on postcard, page 233



Portage End-Mill Driver

End-mill driver that offers a new concept in end-mill cutting announced by Portage Double-Quick, Inc., Akron, Ohio. Many disadvantages of conventional milling are said to be eliminated by this new tool and the methods employed in its use. The end-mill driver has a provision for offset positioning which produces an orbital motion of the cutting tool. This motion permits one-pass cutting of keyways with undersize end-mills and partially eliminates the need for special diameter sizes. It also increases chip clearance, insures square slots, and permits milling true to center line on keyways. The orbital motion has the same speed as the spindle. The end-mill driver also has a four-to-one speed ratio between the spindle and the cutter which enables the driver to do work while the machine runs at a slow speed. This increased speed ratio offers advantages to both old and new machinery. Old machines have an increased speed advantage while newer machines will last longer by running at lower speeds. The driver will accommodate end-mill shank sizes from 3/8 inch to 1 inch. The eccentric micrometer positioning range is from 0 to 0.062 inch off center.

Circle Item 154 on postcard, page 233

(MORTON) ANNOUNCES SIX NEW MODELS

New Boring and Milling Machines Are Competitively Priced

Muskegon Heights, Mich., Dec. 1, 1957 —Morton Manufacturing Company announces the addition of six new horizontal boring, drilling and milling machines to their line. These machines are designed and built for heavy duty work. Outstanding among their design features is the rotating spindle bearing mounted in the Morton-designed **SQUARE RAM.** This unique feature offers at least five times more rigidity than conventional round spindle and quill designs, and insures accuracy up to its maximum extension. The **SQUARE RAM** is shown in the illustration below the Model PC Planer Type Machine.

Complete Range of Models and Sizes

Together with the Model PC, Morton announces the following models, rounding out a line of competitively priced heavy-duty machines that cover a complete range of capacities and types: Model B—Floor Type Boring and Milling Machine, and Model BC, with cross travel; Model P—Planer Type and Model PC, with Cross Travel. These four models are all available in a **SQUARE RAM** size range from 9" to 14", with enclosed spindle size range of 6" to 10". A smaller series, with an 8" **SQUARE RAM** and 5" spindle diameter, is offered in the Model LB Floor Type and LP Planer Type machines.

Accessories Add Versatility

The combination of rotating spindle and **SQUARE RAM,** with the ram as a rigid member, allows unlimited accessory applications at extended distances without the need for accessory supports. A complete new line of quick-change and bolt-on accessories is available, including Right Angle Milling Heads, Speed-Up Heads, Right Angle Slotting Heads and many other attachments that can be positioned within the full machine range. Other accessories such as tapping attachments, boring bars, revolving and angular adjustable work tables, floor plates and many other units help make the Morton line the most versatile on the market. Closed circuit TV is available.

Construction Features

In addition to the **SQUARE RAM,** Morton Boring, Drilling and Milling Machines incorporate the most advanced features of design and construction such as heavily ribbed cast columns, and telescopic instruments and vernier scales for positioning, making them capable of handling highly accurate work, even at their extreme capacities.

MODEL PC PLANER TYPE BORING AND MILLING MACHINE WITH COLUMN CROSS TRAVEL

This machine is offered in a SQUARE RAM size range from 9" to 14". A wide range of table widths is available.

BULLETINS AVAILABLE

Write for bulletins covering the models of interest to you.

Bulletin No.	Model
63	P
64	B
65	PC
66	BC
67	LB
68	LP

Building Quality Machinery Since 1880

MORTON MANUFACTURING COMPANY
Muskegon Heights, Michigan

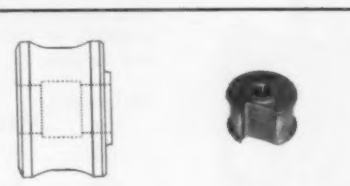
For more information fill in page number on Inquiry Card, on page 233

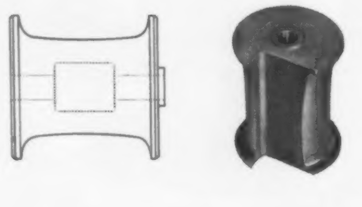
Machining time—cut 40%!

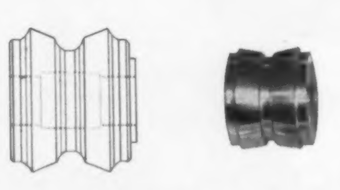
Grinding time—cut 50%!

Grinding wheel cost—cut 25%!

HERE'S TOP FORM TURNING!







Wouldn't you welcome savings like these? S. K. F. Industries, Inc. does, and their happy secret is shown above in an action shot of their Monarch 16″ Series 61 Lathe with Keller controls turning circular form tools from the solid. The figures contrast present against previous production on conventional machines, so widely and wastefully used for this work.

Point is, instead of leaving large amount of stock for final grinding, S. K. F. finds that accuracy of new Monarch with Keller controls enables them to turn and shape directly from the solid within about .0005″ of finish size. And less-skilled operators can machine them faster—before less grinding.

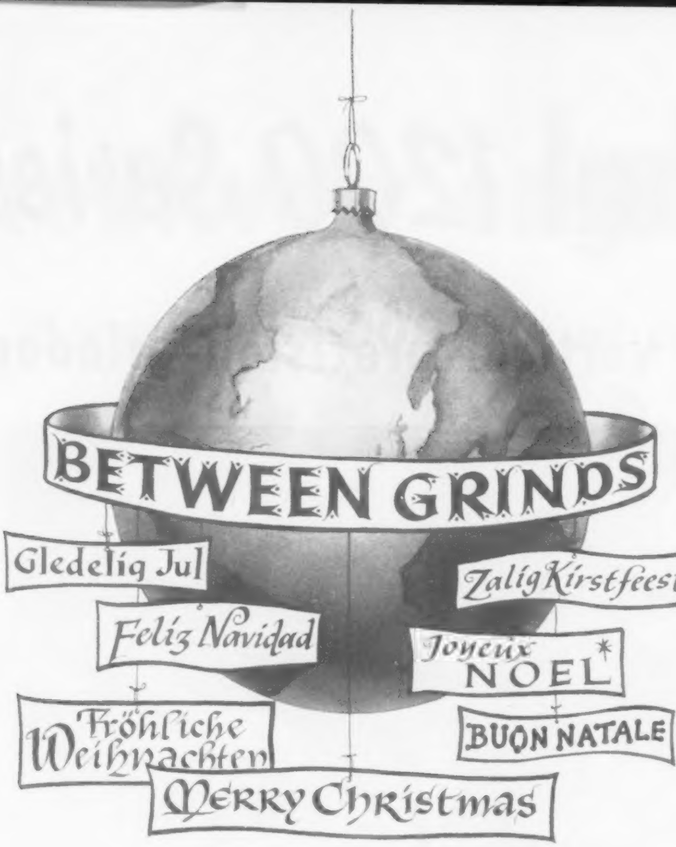
You can't miss savings like these! Challenge us to deliver you better production whatever you turn—and prove it . . .
The Monarch Machine Tool Company, Sidney, Ohio

♦ While flat templates are generally employed with Keller controls, S. K. F. achieves the necessary high accuracy by so positioning master work pieces between centers that stylus follows sharp edge of gash in form tool master. Another savings.

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A BETTER TURN FASTER ...TURN TO MONARCH

For more information fill in page number on Inquiry Card, on page 233



By E. S. Salichs

Merry Moratorium

We wish all MACHINERY's readers a very happy Holiday Season! With so many changing patterns of living seemingly hovering over us, it is a relief to enter the period in which tradition is so well preserved—Christmas trees, turkeys, toys for the youngsters, and convivial get-togethers. Then back to the Atomic Age and Outer Space!

"Just Filled the Bill"

Up a Christmas tree as to a gift for that friend or relative who has everything? A gourmet shop advertised these treats: crunchy chocolate-covered ants, juicy baby octopus, tender rattlesnake meat, plump roasted caterpillars, and crisp-fried bumble bees.

Authors Acknowledged

Any Pratt & Whitney employe who by-lines an article published in a national magazine receives from the company the Charter Oak Award and a check for $50. So when Milton Jensen wrote an article accepted for publication in MACHINERY, he received the C.O.A. certificate from Edward P. Gillane, president and general manager of Pratt & Whitney Co., Inc. The Award is considered a distinct honor, and since the system was organized late in 1955, more than fifty employes have received certificates.

Father Becomes Mother of Necessity

Trying to juggle a bottle and feed his month-old, squirming son, a father murmured "If only I had a third arm." Baby back in the crib, he rushed down to the basement and began cutting and shaping a piece of metal. Now on the market, the Third Arm holds telephones, mirrors, baby bottles, et al.

Bye, Bye, Bat

"Eliminating Bats from Buildings" is a Government Printing Office publication, curiously in demand with the public. One explanation occurred to us: interpretation of the word bats to include peculiar neighbors.

Rolled Out the Carpet, Too

A new customer service has been established by the Rolled Steel Corporation, Skokie, Ill. It has invited 25,000 manufacturers to set up temporary business headquarters at its plant when traveling through Chicago—air-conditioned conference rooms, telephone facilities, and the services of a receptionist.

And Bright as a Button

The Univac that carries on Atomic Energy Commission work at New York University recently celebrated its fourth birthday at a party given by co-workers and friends. The festivities were complete with cake and soft drinks, as befitting a minor. The highlight was the precocious performance of Univac itself which sang in its piccolo-like voice, "Happy Birthday to Me." This was accomplished by controlling the frequency of the transfer of electrical information from one point of the machine to another.

Time Stopped, He Marches on

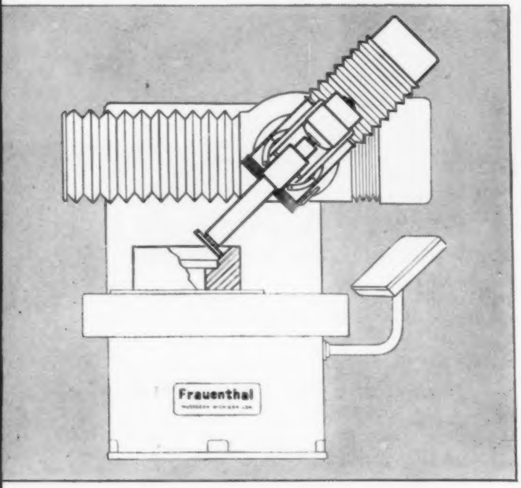
A salesman demonstrating a shockproof, waterproof watch misread its other attribute, dustproof for bustproof, in a product description released by the manufacturer.

Mountains to Scale

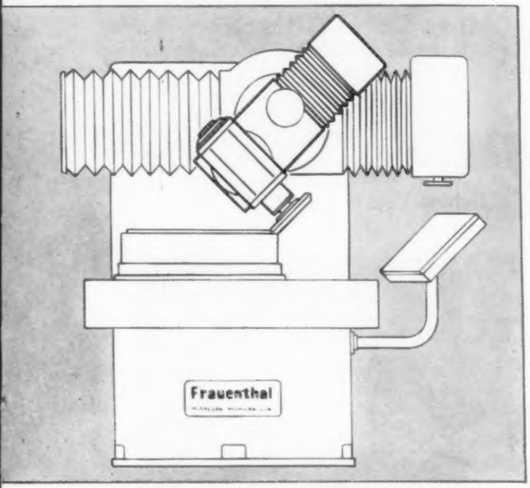
A mountain-building model machine has been designed by the Gulf Oil Corporation, according to *Industrial Research Newsletter*, that "rebuilds" the earth on a miniature scale to find how and where oil traps are formed. The mountains are cut into cross-sections and their structure studied. Eventually, the researchers hope to reproduce mountain growth realistically enough to pin-point likely oil locations in selected areas. Likely, not our backyard.

creatively engineered

...accuracy to .000100" at spindle nose



Frauenthal belt-driven Model 1224B and 1236B single spindle, vertical precision grinders have an extreme angle setting of compound at 45°. Versatility such as this permits angle, internal, external and face grinding to millionths-of-an-inch related tolerances.



Frauenthal direct-connected Models 1224D and 1236D are ideal for rotary surface grinding, O.D. surface and angular approach grinding operations. A variety of grinding spindle positions is possible with this head arrangement.

assures uniform, super-precision part after part!

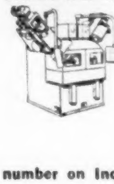
Super-precision is the natural result of overall Frauenthal single spindle, vertical precision grinder rigidity; of proven performance . . . and *continuous* application of advanced grinding techniques.

These new Frauenthal 1200 Series machines are available with choice of belt-driven or direct-connected grinding spindles. Machines with either spindle arrangement are offered with 24" dia. tables x 36" swing and 36" dia. tables x 48" swing capacities inside splash guards. Additional swing can be obtained by removing guards.

Write for free Bulletin

1200 Series
36-48" Swing

Special Grinding
Machines using
standard Slide Units



Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN, U. S. A.

For more information fill in page number on Inquiry Card, on page 233

News OF THE INDUSTRY

Florida and Georgia

SOUTHERN TOOL DISTRIBUTING Co., Atlanta, Ga., has in its Atlanta, Ga., warehouse a complete stock of metal-cutting tools, precision tools, and diemakers' supplies to serve customers south of New York. This new company is headed by R. L. HILL.

SOUTHEAST MACHINERY Co., Fort Lauderdale, Fla., has been formed to meet the growing machine tool requirements of Florida's manufacturing industries. Associated in the new state-wide organization are GEORGE HABICHT, JR., chairman of the board of Marshall & Huschart Machinery Co., Chicago, Ill.—president; RICHARD W. BANFIELD, president of Motch & Merryweather Machinery Co., Cleveland, Ohio—secretary; and THOMAS R. RUDEL, president and chairman of the board, Rudel Machinery Co., Inc., New York—treasurer. Sales engineering and service operations of the company will be in charge of E. L. EVELETH, vice-president and general manager.

WALLACE SUPPLIES MFG. Co., Chicago, Ill., has opened an office in Los Angeles, Calif. ARNOLD H. JOHNSON is the new manager.

GEORGE C. JOHNSON has been elected president and general manager of the Rehnberg-Jacobson Mfg. Co., Rockford, Ill.

George C. Johnson, president and general manager, Rehnberg-Jacobson Mfg. Co.

(Left) Joseph H. Buhr, president, and (Right) W. R. Gerchow, executive vice-president and general manager, Buhr Machine Tool Co.

ROPER HYDRAULICS, INC., Rockford, Ill., a new corporation, began operation November 1 and has taken over the pump business of George D. Roper Corporation, Pump Division, Rockford, Ill. The officers of the new company are JOHN H. MAKEMSON, president; FRED DICKERSON, vice-president; and CHARLES OEHLER, secretary-treasurer.

JOHN S. BARNES CORPORATION, Rockford, Ill., has announced the following appointments: HARRY CRAMER, assistant sales manager for automotive and mass-production industries; CARL LINDE has been promoted to assistant sales manager for machine tool hydraulics and related structures; and RALPH W. PALMER has been named technical sales manager.

DAVID G. COLLINS has been named vice-president of SpeedWay Mfg. Co., Cicero, Ill., a subsidiary of Thor Power Tool Co., Chicago, Ill.

HOWARD C. CARLESS has been named assistant general manager of the Terre Haute, Ind., works, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Michigan and Ohio

BUHR MACHINE TOOL Co., Ann Arbor, Mich., has announced the purchase of the SIDNEY MACHINE TOOL Co., Sidney, Ohio, manufacturers of heavy-duty, precision metal-working lathes. Sidney Machine Tool Co. will be operated as a wholly owned subsidiary, and its administrative officers are JOSEPH H. BUHR, president, and W. R. GERCHOW, executive vice-president and general manager.

DETROIT TAP & TOOL Co., Baseline, Mich., has appointed three new representatives to serve metalworking plants in three vital industrial areas. They are R. VAN ALSTYNE TOOL Co., Schenectady, N.Y.; J. RAY UBER, Monroeville, Pa.; and ROBERT N. KENDALL, Milwaukee, Wis.

DON W. BRANNING has been appointed manager of the American Broach & Machine Division, Ann Arbor, Mich., of the Sundstrand Machine Tool Co., Rockford, Ill.

Don W. Branning, Manager, American Broach and Machine Division, Sundstrand Machine Tool Co.

A. Standard DB 24 Spindle
B. DB 50 Motorized Spindle
C. DB 25 Square Body Spindle
D. DB 50 Motorized Quill-Type Spindle
E. DB 22 Square Body Spindle
F. Standard DB 22 Spindle

57-90

Greater Accuracy—with Ex-Cell-O Precision Boring Spindles

No one need tell you of the proven superiority of Ex-Cell-O precision boring spindles where close tolerances and fine finishes are required. But, did you know that these same Ex-Cell-O boring spindles have been used as replacement units for years?

Produced in belt-driven, standard motorized, or high frequency motorized styles, these Ex-Cell-O precision spindles are equipped with XLO Precision bearings for maximum spindle rigidity, long life and smooth operation. Permanent bearing lubrication reduces maintenance costs, prolongs bearing life.

For complete information, why not get in touch with your local Ex-Cell-O representative or, if you prefer, send direct for bulletin 25477.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES
CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

SNYDER TOOL & ENGINEERING Co., Detroit, Mich., has announced the completion of a factory expansion program designed to provide new and larger floor space for assembly, electrical, and hydraulic departments. The expansion is the second stage of a planned program at the company's main assembly plant. The new $80,000 building contains 5520 square feet.

ERNEST W. MARCHAND has been appointed plant manager of the Plymouth Detroit body plant, Plymouth Division, Chrysler Corporation, Detroit, Mich.

TAYLOR-WINFIELD CORPORATION, Warren, Ohio, has purchased from Struthers-Wells Corporation, Titusville, Pa., facilities and inventories used by Struthers-Wells in the design, manufacture, and sale of its line of metal-forming and work-handling machinery. Struthers-Wells has ceased the manufacture of this machinery except to complete such orders as are currently being built. Key personnel of this activity entered the employ of Taylor-Winfield and will continue to design, sell, and service this specialized line of equipment.

LINCOLN ELECTRIC CO., Cleveland, Ohio, has announced the following changes in its district offices: BRUCE N. FRYE has been transferred to Columbus, Ohio, and EDWIN WILLIAMS, to Birmingham, Ala.; and GERALD R. STOECKINGER has joined the Los Angeles, Calif., office.

E. W. BLISS CO., Canton, Ohio, has announced two executive assignments: WILLIAM STAECKER has joined the general office staff as assistant manager of engineering for the company's Press Division; and ALFRED DRAIN replaces Mr. Staecker as chief engineer of the Canton Division.

T. LAURENCE STRIMPLE, secretary and general counsel, National Acme Co., Cleveland, Ohio, has been elected to the position of president. Mr. Strimple replaces FREDERIC H. CHAPIN, chairman of the board and former president, which office Mr. Chapin resigned after serving thirty-one years. He will continue as chairman of the board.

T. Laurence Strimple, president, National Acme Co.

NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION, Cleveland, Ohio, elected at its annual meeting in Chicago, Ill., the following officers for 1958: PHILIP R. MARSILIUS, executive vice-president of Producto Machine Co., Bridgeport, Conn.—president; JACK KLEINODER, secretary-treasurer of Volkert Stampings, Inc., Queens Village, N. Y.—first vice-president; HAROLD G. MURDOCK, vice-president of Arrowsmith Tool & Die Corporation, Los Angeles, Calif.—second vice-president; ROBERT C. RENNER, president of East Dayton Tool & Die Co., Dayton, Ohio—re-elected treasurer; and JAMES A. PERDY, vice-president of Atlantic Mfg. Co., Philadelphia, Pa.—secretary. Executive vice-president GEORGE S. EATON and assistant executive secretary CHARLES R. BENDER will continue in their respective capacities.

Philip R. Marsilius, president, National Tool & Die Manufacturers Association

GREAVES MACHINE TOOL CO., Cincinnati, Ohio, a division of J. A. Fay & Egan Co., has appointed three representatives: TRI-STATE MACHINERY CO., Pittsburgh, Pa.; GULF INDUSTRIAL SUPPLY CO., St. Petersburg, Fla.; and W. D. ALLEN MFG. CO., Chicago, Ill.

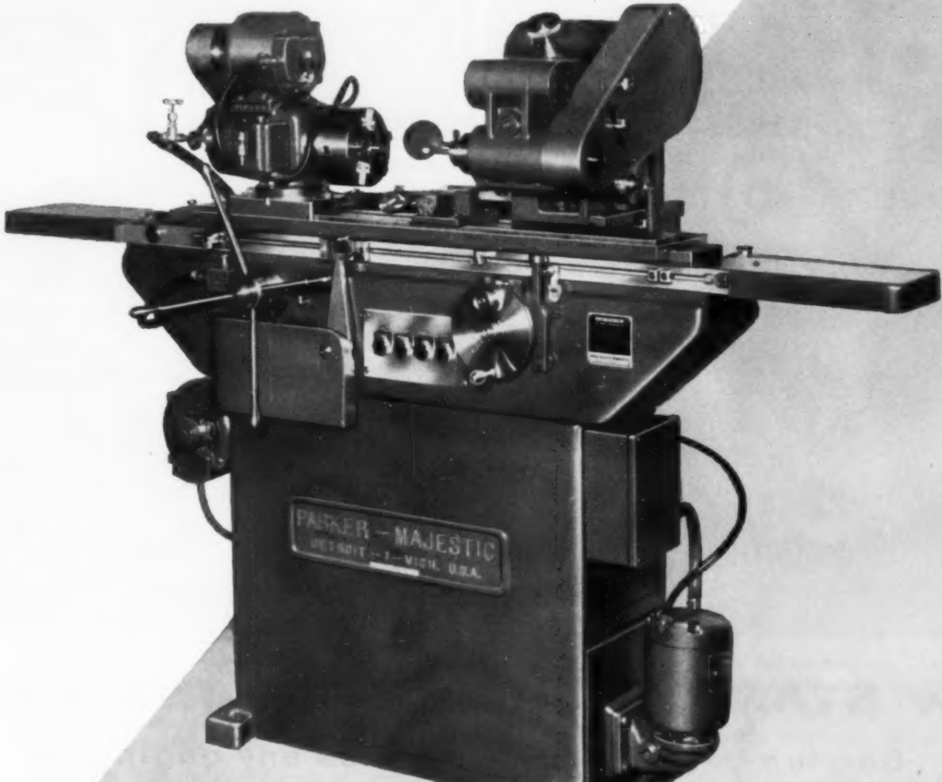
UNITED STATES DRILL HEAD CO., Cincinnati, Ohio, has announced the appointment of C. C. GARRETT MACHINERY CO., Indianapolis, Ind., as exclusive representative in the company's Indiana and Kentucky territory.

CONTINENTAL TOOLING SERVICE, INC., Dayton, Ohio, has changed the company name to CONTINENTAL TECHNICAL SERVICE, INC.

JOHN R. DAVIS has been appointed southeastern representative for the Osborn Mfg. Co., Cleveland, Ohio.

(This section continued on page 256)

(Left) William Staecker, assistant manager of engineering, Press Division, and (Right) Alfred Drain, chief engineer, Canton Division, E. W. Bliss Co.



For more information fill in page number on Inquiry Card, on page 233

For more information fill in page number on Inquiry Card, on page 233

Drilled Holes for Tapping - I

Taps are conspicuously different from all other cutting tools in that their nature allows little variation in operating conditions. The feed per revolution is fixed by the lead or pitch of the tap. The rate of metal removed per tooth is thus governed by the effective chamfer length, the R.P.M., and the minor diameter of the product. In addition, the application of cutting fluid is difficult, the chips cannot always be removed from the cutting zone and the cross-sectional area of the tap is often small compared to the load imposed. Since the freedom of choice as to relief, rake, and shear angles is frequently limited, and the tap must usually stop and reverse in the cut, it should be realized that every reasonable precaution should be taken to favor the tap.

The proper care and usage of drills with equipment in good condition is of utmost importance in the production of satisfactory holes for tapping.

In most materials a drill may be expected to cut oversize. Since a drill is primarily a roughing tool, deviations in the size of drilled holes are to be expected, even under ideal operating conditions. When closer control over hole size is required then reaming becomes necessary. Reaming is generally recommended for the larger tap diameters and some fine pitches.

As the percentage of thread is increased the tapping torque is greatly increased, resulting in unsatisfactory tapped holes, breakage of taps, and high cost. It is, therefore, desirable to utilize the lowest percentage of thread consistent with adequate strength.

Thread strength tests clearly show that any increase in the percentage of thread over 60% does not increase the strength. For the vast majority of tapped hole requirements a minor diameter which provides a 55% to 65% thread is adequate. It must be recognized that present specifications do not always allow the use of these smaller thread percentages. Product blueprint specifications will, at times, require adherence to minor diameters smaller than those ordinarily recommended.

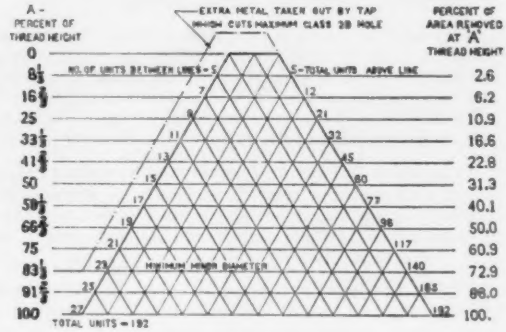
There are four general groups of tapped holes—the first and largest being those into which a threaded part is screwed for fastening purposes only and left either for the life of the part or until repairs are needed.

Second are those holes which are used for the adjustment of parts of a machine where the screw or bolt may be tightened or loosed many times within a short period of time.

Third are holes in which a screw is used for moving a slide or nut and holding it at a desired location.

Fourth are holes for studs.

The first group include the greater percentage of holes tapped with National Thread Form and is the



BASIC 10 24 N.C. THREAD
HEIGHT .02706 CLASS 2B TOL.=.0043

group for which reasonable recommendations on minor diameter can be made. Some holes in the second group can be included but the other applications may require individual attention.

In Unified and American Screw Threads, A.S.A. B1.1-1949 and Screw Threads for Federal Services, Handbook H-28, the maximum minor diameter runs from about 53% engagement with a basic thread plug on a No. 0-80 to about 74% engagement on ½" diameter and larger.

Tests have shown an increase in tapping torque resulting from a decrease in minor diameter. Two of the principal reasons for this should be well understood.

First, the increase in material removed is shown in sketch — where a 10-24 basic screw thread is shown by the heavy outline and the Class 2B maximum tapped hole size is shown by the dot and dash lines.

As the thread height increases, the width of chip and amount of material removed increases rapidly. The sketch shows that on a basic thread form a 50% thread height represents the removal of only 31.25% of the basic thread area, while an increase to 75% thread height increases the area to be removed to 60.9%, or practically double the first amount. With the tapped hole increased to the maximum pitch diameter, the above figures increase to approximately 40% and 72% of the area.

The second cause of increase in torque is that, except in the case of spiral point or spiral flute taps, when a tap enters a drilled hole it starts cutting chips which will usually remain in the flutes as the tap advances. If stringy chips result, they roll over and over between the minor diameter of the hole and the bottom of the flutes, resulting in considerable friction. As the drilled hole becomes smaller,

Extracted from "Standards and Dimensions for Taps and Dies" with permission of the publisher, Tap and Die Division, Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y.

Drilled Holes for Tapping (Continued)

the amount of chips to be taken care of becomes so great that the friction generated may require as much power as does the actual cutting.

This friction increase is apparent where the power used in cutting cast iron with its fine crumbling chips, increases in proportion to the metal removed, but the curling chips from No. 1020 A.I.S.I. steel clog the flutes of the tap, resulting in an increase in torque detrimental to the tap.

In addition to causing friction, these curling chips score and tear the thread, resulting in rough and oversize holes and leading to work rejection. This is especially true of the Coarse Thread series in sizes ½" and smaller

While the minor diameter limits as published give a very satisfactory threaded hole, if they can be obtained, there are many cases where a larger hole will save in time and tool cost. It has been demonstrated that in general the bolt, or external thread, breaks at about 55% thread engagement, and that there is very little increase in the strength of the nut when the thread height is increased. This agrees with findings in a pamphlet published by the National Screw Machine Products Association.

It is, therefore, to the advantage of users of taps to keep the minor diameter as large as possible. If tapping difficulties still continue, the Fine Thread Series should be considered, as the volume of chips is so much smaller and the strength of the internal thread is practically the same.

It must be remembered that usually the part to be tapped is the most valuable and that the balance of strength should be in the tapped hole.

In the following table is shown both the theoretical percentage of thread represented by the drill size and the percentage that would normally be obtained in drilling based on the test data compiled by M.C.T.I.

TAP DRILL SIZES Probable Percentage of Full Thread Produced in Tapped Hole Using Stock Sizes of Drill

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Theoretical % of Thread	Probable Oversize (Mean)	Probable Hole Size	Percentage of Thread
0-80	56	.0465	83	.0015	.0480	74
	3/64	.0469	81	.0015	.0484	71
1-64	54	.0550	89	.0015	.0565	81
	53	.0595	67	.0015	.0610	59
1-72	53	.0595	75	.0015	.0610	67
	1/16	.0625	58	.0015	.0640	50
2-56	51	.0670	82	.0017	.0687	74
	50	.0700	69	.0017	.0717	62
	49	.0730	56	.0017	.0747	49
2-64	50	.0700	79	.0017	.0717	70
	49	.0730	64	.0017	.0747	56
3-48	48	.0760	85	.0019	.0779	78
	5/64	.0781	77	.0019	.0800	70
	47	.0785	76	.0019	.0804	69
	46	.0810	67	.0019	.0829	60
	45	.0820	63	.0019	.0839	56
3-56	46	.0810	78	.0019	.0829	69
	45	.0820	73	.0019	.0839	65
	44	.0860	56	.0019	.0879	48
4-40	44	.0860	80	.0020	.0880	74
	43	.0890	71	.0020	.0910	65
	42	.0935	57	.0020	.0955	51
	3/32	.0938	56	.0020	.0958	50
4-48	42	.0935	68	.0020	.0955	61
	3/32	.0938	68	.0020	.0958	60
	41	.0960	59	.0020	.0980	52
5-40	40	.0980	83	.0023	.1003	76
	39	.0995	79	.0023	.1018	71
	38	.1015	72	.0023	.1038	65
	37	.1040	65	.0023	.1063	58

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Theoretical % of Thread	Probable Oversize (Mean)	Probable Hole Size	Percentage of Thread
5-44	38	.1015	79	.0023	.1038	72
	37	.1040	71	.0023	.1063	63
	36	.1065	63	.0023	.1088	55
6-32	37	.1040	84	.0023	.1063	78
	36	.1065	78	.0026	.1091	71
	7/64	.1094	70	.0026	.1120	64
	35	.1100	69	.0026	.1126	63
	34	.1110	67	.0026	.1136	60
	33	.1130	62	.0026	.1156	55
6-40	34	.1110	83	.0026	.1136	75
	33	.1130	77	.0026	.1156	69
	32	.1160	68	.0026	.1186	60
8-32	29	.1360	69	.0029	.1389	62
	28	.1405	58	.0029	.1434	51
8-36	29	.1360	78	.0029	.1389	70
	28	.1405	68	.0029	.1434	57
	9/64	.1406	68	.0029	.1435	57
10-24	27	.1440	85	.0032	.1472	79
	26	.1470	79	.0032	.1502	74
	25	.1495	75	.0032	.1527	69
	24	.1520	70	.0032	.1552	64
	23	.1540	67	.0032	.1572	61
	5/32	.1563	62	.0032	.1595	56
	22	.1570	61	.0032	.1602	55
10-32	5/32	.1563	83	.0032	.1595	75
	22	.1570	81	.0032	.1602	73
	21	.1590	76	.0032	.1622	68
	20	.1610	71	.0032	.1642	64
	19	.1660	59	.0032	.1692	51

NOTE—This table to be continued in Data Sheet for February, 1958, MACHINERY

Extracted from "Standards and Dimensions for Taps and Dies" with permission of the publisher, Tap and Die Division, Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y.

Joseph E. Praser, general superintendent, Cleveland, Ohio, steel service plant, Joseph T. Ryerson & Son

JOSEPH E. PRASER has been appointed general superintendent of the Cleveland, Ohio, steel service plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill.

ALVIN J. JONES has been appointed director of engineering of Motch & Merryweather Machinery Co., Cleveland, Ohio.

New England

JOHN WENTWORTH has been appointed general manager of the Dayton, Ohio, division of Associated Spring Corporation, Bristol, Conn. He succeeds HARRY B. DAUPHINAIS, who was recently appointed general manager of the corporation's William D. Gibson Co. Division in Chicago, Ill.

EDWARD W. MOFFITT has been appointed general manager of the Bridgeport, Conn., plant of Heppenstall Co., Pittsburgh, Pa.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., has moved its Akron, Ohio, office to new quarters at 665 W. Market St.

DOGAN H. ARTHUR has been elected vice-president of sales for Titeflex, Inc., Springfield, Mass.

JAY D. SHERMAN has been appointed eastern sales manager of Reed-Prentice Corporation, Worcester, Mass., a subsidiary of Package Machinery Co.

NORTON CO., Worcester, Mass., has created two new positions in sales management of its Abrasive Division effective January 1958: ROBERT CUSHMAN will become manager of marketing services; W. ALEXANDER MCCUNE, JR., manager of field sales.

WILLIAM H. MCCARTY, JR., has been appointed district manager for sales engineering work for Latrobe Steel Co., Latrobe, Pa. Mr. McCarty's headquarters will be in Boston, Mass. He replaces ROBERT ROSE, who died in an automobile accident recently.

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., has moved its New York office and warehouse to 32 Worth St., New York City.

George M. Brydon, General Manager, Butterfield Division, Union Twist Drill Co.

GEORGE M. BRYDON has been appointed general manager of the Butterfield Division of Union Twist Drill Co., Derby Line, Vt.

BROWN & SHARPE MFG. CO., Providence, R. I., has announced an agreement with LIPE-ROLLWAY CORPORATION, Syracuse, N. Y., to sell the latter's automatic magazine-loading bar feed for installation on Brown & Sharpe single-spindle automatic and hand screw machines. The agreement permits Brown & Sharpe to install, service, and maintain the Lipe bar feed together with the above machines anywhere in the United States and Canada.

New York and New Jersey

U. S. INDUSTRIES, INC., New York City, has reorganized and consolidated manufacturing and marketing functions in three of its major divisions. In the reorganization Axelson Mfg. Co., Los Angeles, Calif., has moved their engine-lathe production operations to the Clearing Machine Division with plants in Chicago and Hamilton, Ohio. The lathes will be manufactured by Clearing but they will continue to be sold by Clearing under the Axelson name. Axelson aircraft production, principally involving landing gears, struts, hydraulic equipment, etc., has for administration purposes been consolidated with WESTERN DESIGN & MFG. CORPORATION, Santa Barbara, Calif. Axelson's new aircraft facility in Montebello, Calif., will enlarge its scope to include the manufacture of electronic and electromechanical devices developed by Western Design. Clearing Machine Corporation, Chicago, Ill., has become U. S. Industries' central producer of heavy-duty machine tools, presses, and lathes. Axelson, already a major producer of oil fuel equipment, including pumps, sucker rods, and allied equipment, will expand even more in this field.

CLINTON E. SMITH has been elected president of the Solid Carbide Institute, a national organization with headquarters in New York City and composed of fifteen industrial companies that manufacture solid carbide tools. Mr. Smith is assistant to the general sales manager of Pratt & Whitney Co., Inc., West Hartford, Conn.

STANDARD GAGE CO., INC., Poughkeepsie, N. Y., has announced the appointment of KENNETH E. WANDEL as direct branch office representative in the Chicago area. PAUL L. KRUEGER has assumed a similar position in the company's Philadelphia territory.

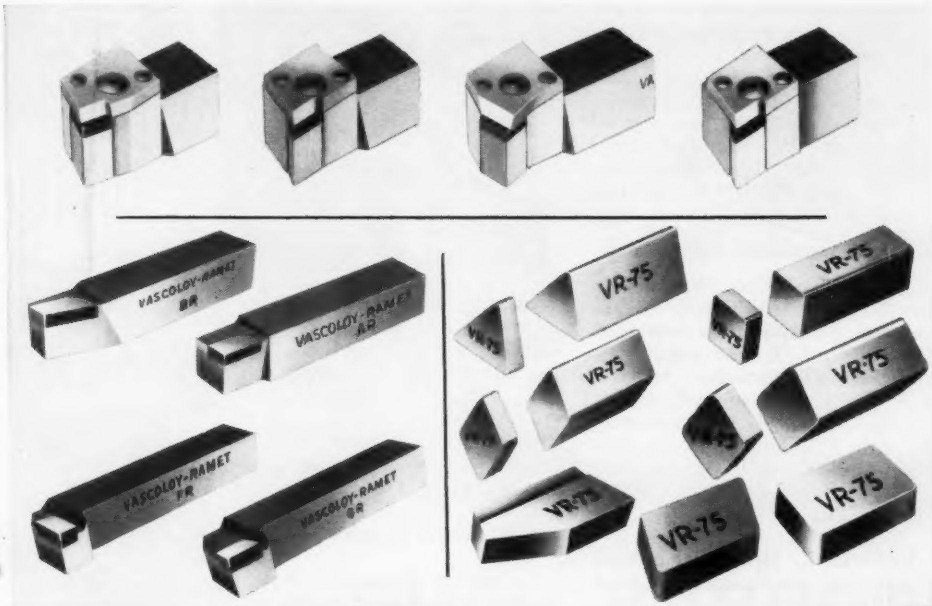
JOHN J. LOHRMAN has joined Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y., as manager of distribution to head the newly organized department of distribution.

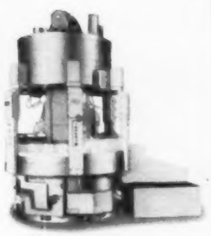
OAKITE PRODUCTS, INC., New York City, has announced two new technical service representatives—DONALD R. DUTTON has been assigned to Lansing, Mich.; GEORGE D. FINDLAY III, to Vermont.

J. BARRIE GRAHAM has been promoted to the position of director of research, Buffalo Forge Co., Buffalo, N. Y.

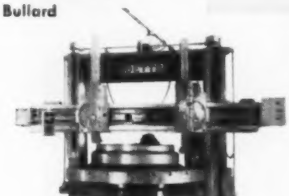
ROBERT R. MILLER has been appointed Western sales representative for Consolidated Machine Tool Divi-

VR-75 ...A Superior Carbide Grade for vertical turret lathe and boring mill operations

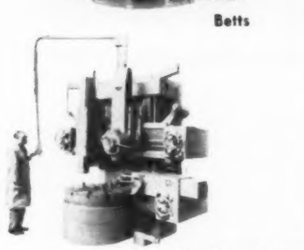




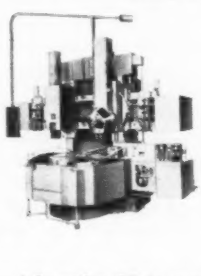
Bullard



Betts



Gidding & Lewis



King

VR-75 super steel-cutting carbide grade outperforms all other carbide grades on heavy machining operations where high heat is generated. Its high heat resistance, high shock resistance and high edge strength have proven to greatly increase production on vertical turret lathe and boring mill operations. For example, a leading gear manufacturer in Southern Ohio doubled production with VR-75 on the following operation:

Machine:	Vertical boring mill
Operation:	Turning 26″ O.D.
Material:	4550 heat-treated steel
Depth of cut:	3/8″ to 1/2″
Coolant:	None

	Previous Carbide	VR-75
RPM	32	58
SFPM	220	400
FEED	.012″	.016″

In addition to its outstanding performance on tough jobs, VR-75 gives excellent performance on a wide range of general steel machining operations. For complete information on the application of VR-75, call on the assistance of your skilled local V-R field service engineer. He can help you achieve major production economies with this new machine.

ASK FOR LITERATURE

VR-75 is available in inserts, blanks and tools for all types of machining, as described and priced in new BULLETIN No. 577. Ask for your copy, without obligation.

C-644

MANUFACTURERS OF:

CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

898 Market Street, Waukegan, Illinois

For more information fill in page number on Inquiry Card, on page 233

sion of Farrel-Birmingham Co., Inc., Rochester, N. Y.

Permacel Tape Corporation, New Brunswick, N. J., has changed its name to Permacel-LePage's, Inc.

Pennsylvania

Trent Tube Co., East Troy, Wis., a wholly owned subsidiary of Crucible Steel Company of America, Pittsburgh, Pa., has announced two appointments in its general sales department. Charles A. Kuhnmuench has been made sales manager for the Chicago-Indianapolis-St. Louis district with headquarters in Chicago. William H. Collins has been named sales manager for the Pittsburgh-Cleveland-Cincinnati district with headquarters in Pittsburgh.

Landis Tool Co., Waynesboro, Pa., has appointed the R. O. Deaderick Co., Orlando, Fla., exclusive distributor for Landis grinders in the central Florida area.

Carl Benson is now operating out of the Philadelphia office as sales engineer for Clearing Machine Corporation, division of U. S. Industries, Inc., Chicago, Ill.

Kenneth E. McKown has been promoted to assistant manager, Steel Sales Division, Firth Sterling Inc., Pittsburgh, Pa.

Kennametal Inc., Latrobe, Pa., has announced the appointment of Hart Industrial Supply Co., Tulsa, Okla., as distributor for its hard-carbide metal-cutting tools in the Oklahoma territory. The company also

Roger M. McCray, district manager, Kennametal Inc.

has established a Cleveland, Ohio, district office with Earle E. Boyer as manager. Roger M. McCray has been appointed district manager in Cincinnati, Ohio, to replace George J. Raible, who retired.

Albert C. Wedge, vice-president in charge of manufacturing, DeWalt Inc., subsidiary of American Machine & Foundry Co.

Albert C. Wedge has been elected vice-president in charge of manufacturing for DeWalt Inc., Lancaster, Pa., subsidiary of American Machine & Foundry Co.

Carpenter Steel Co., Reading, Pa., has opened a mill branch warehouse and office in Chicago, Ill. It will be the midwestern headquarters for both the parent company and its Alloy Tube Division.

Crucible Steel Company of America, Pittsburgh, Pa., has announced that, subject to Securities and Exchange Commission approval, it has acquired 100 per cent ownership of Rem-Cru Titanium, Inc., Midland, Pa.

Westinghouse Electric Corporation, Pittsburgh, Pa., has announced that two Belgian ironworks firms—Ateliers de Constructions Electriques de Charleroi (ACEC) and S. A. Cockerill-Ougree—have signed license agreements with Westinghouse Electric International Co. which will permit them to manufacture and sell all the non-military types of reactors developed by the American company. At the same time, Westinghouse has announced the appointment of Edward E. Lacy as Pacific Coast manager of machinery electrification. Mr. Lacy will make his headquarters at 410 Bush St., San Francisco. Also M. L. McCartney has been appointed works manager for the distribution transformer department of the Westinghouse Transformer Division, Sharon, Pa. Mr. McCartney replaces C. E. Hutchison, who was recently named works manager for the company's new distribution transformer plant, now under construction in Athens, Ga.

Edgar W. Engle has been appointed development engineer of Kennametal Inc., Latrobe, Pa. Mr. Engle will be concerned with the development of new products in connection with the company's current expansion program.

Obituaries

Clayton R. Burt

Clayton R. Burt, internationally known in the machine tool business and a former president and chairman of the board for Niles-Bement-

Clayton R. Burt

Pond Co., now Pratt & Whitney Co., Inc., died October 21 at the age of eighty-two years. Mr. Burt was also a former president of Potter & Johnston Co., Pawtucket, R. I., a Niles division. During his active career he had worked for Brown & Sharpe Mfg. Co., Providence, R. I.; Barber-Colman Co., Rockford, Ill.; Russell Motor Car Co., Toronto, Canada; New Process Gear Co., Syracuse, N. Y.; and Austin Machinery Co., Toledo, Ohio. At the time of his retirement in 1950 he had been active in Pratt & Whitney affairs for more than a quarter of a century. The company has recently established a scholarship in his name to go each

XLD EX-CELL-O FOR PRECISION

CHIP-BREAKER ASSEMBLY: On the opposite end, mounted under the reciprocating chip-breaker wheel is the chip-breaker table with vertical adjustments. It accommodates adjustable tool block fixture which holds tool in place while grinding chip-breaker groove at desired angle.

TWO MODELS AVAILABLE: Style 142 for conventional grinding with vitrified or diamond wheels; Style 264, equipped with metal-bonded diamond wheels, for *electrolytic* grinding.

new DUAL PURPOSE RECIPROCATING TOOL GRINDER

Ex-Cell-O takes all the work out of both conventional and chip-breaker tool grinding

Now an entirely new reciprocating double end tool grinder designed by Ex-Cell-O to do two jobs in one—conventional grinding on one end, chip-breaker grinding on the other—has now been added to Ex-Cell-O's line of conventional, double end, carbide and Method X tool grinders. The difference is the adjustable, power-controlled reciprocation of grinding wheels. The operator need only hold the tool at the pre-set angle.

Other features of this new grinder include: variable stroke (0 to 1½"); variable number of reciprocations (0 to 220 strokes per min.); in-built motorized precision grinding spindle, saddle-mounted to reciprocate along hardened and ground bars which are mounted on pre-loaded ball bushings. You'll want to see for yourself the capabilities of this new Ex-Cell-O—to do so, simply contact your local Ex-Cell-O Representative. Or, if you wish, write direct to Ex-Cell-O, Detroit. Ask for Bulletin 461872.

EX-CELL-O CORPORATION
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Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-25

year to a deserving son or daughter of one of the company's employes. Mr. Burt's activities in behalf of the machine tool industry brought him the presidency of the National Machine Tool Builders Association in 1936 and 1937. Last year top officials of the Association presented him with a large silver bowl with engraving expressing the affection in which he was held by the entire machine tool industry.

EDGAR O. LANDSTROM, secretary of Sundstrand Machine Tool Co., Rockford, Ill., died October 31st at the age of fifty-eight years. Mr. Landstrom joined Sundstrand in 1949 and became secretary of the company in 1951.

New Books and Publications

WORK SAMPLING. By Ralph M. Barnes. 283 pages, numerous charts and tables. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.95.

This book offers a thorough analysis of the work sampling technique—an important tool of work measurement and analysis. It is an excellent reference and guide, and the fundamentals of the work sampling technique are explained clearly and lucidly. Specific directions are offered to show how to apply this measurement technique in an individual office or factory. The book also offers detailed results of research done in the field (including Tippett's pioneering paper on the subject) and provides case histories, contributed by men of national prominence in the field, which illustrates the applications of the technique in actual situations.

CAST METALS HANDLING. Published by American Foundrymen's Society, Inc. Golf and Wolf Roads, Des Plaines, Ill. 320 pages, 8½ by 11 inches. Price, $10; available to AFS membership at $7 per copy.

This manual is for design engineers' use when developments from drawing boards and research laboratories must be converted into components and end products. It is compiled specifically to enable the user of cast metals to select the material best suited for his purpose, and to give him the needed information that will facilitate cooperation with foundries to obtain castings which will best meet his engineering requirements.

Reliable working data is presented for utilizing properties of cast metals to the greatest engineering advantage, unbiased and substantiated information on new developments in cast materials, and practical up-to-the-minute facts on how to get the most out of castings designs.

MATERIALS HANDLING EQUIPMENT. By D. Oliphant Haynes. 636 pages, 2200 illustrations. Published by Chilton Co., Inc., 56th and Chestnut Sts., Philadelphia 39, Pa. Price, $17.50.

This book presents the complete story of machines and systems, what they do, and how they do it. It brings its readers a total perspective that will enable them to spot key areas to watch, over-all systems to compare, new equipment to consider, and most important, a fundamental basis for planning materials-handling operations, which account for 25 per cent of production cost.

Some of the topics considered are basic types of equipment and their capabilities, unit-load handling, in-process handling, integration of production machinery with handling equipment, package handling, techniques for analyzing specific problems, analysis and design of handling systems, cost analysis, and organization control of handling systems.

MANUAL OF INSTRUCTIONS FOR ARC WELDING. 40 pages. 8 1/2 by 11 inches. Published by James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. Paperbound. Price, 50 cents postpaid in the United States.

A guide to learning the basic skills of arc welding, this manual contains explanatory diagrams, illustrations, and ideas for useful projects. It can be used for self-instruction or as a text for a basic course in arc welding.

Subjects treated are: basic welding techniques and skills; the effect of heat on metals; common high carbon alloy and tool steels and their preparation for welding; brazing, cutting, soldering, hard-surfacing; pipe welding and sheet-metal welding, as well as welding supplies and equipment. The book contains an outline for condensed study and its general level of writing and subject matter presentation is aimed at high school teaching.

Coming Events

DECEMBER 1-6—Annual Meeting of American Society of Mechanical Engineers has been announced. Concurrent with the ASME sessions will be the annual meeting of the American Rocket Society, an affiliate of ASME. Meetings will be held at the Statler and McAlpin hotels. Further information may be obtained from the ASME Meetings Department, 29 W. 39th St., New York 18, N. Y.

JANUARY 13-17—Annual meeting and display of the Society of Automotive Engineers has been announced. It will be held at the Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

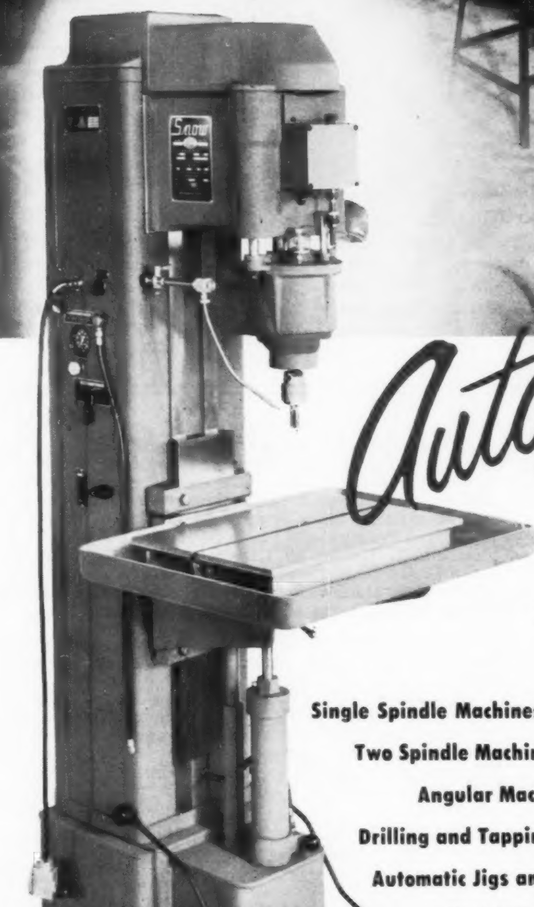
JANUARY 27-30—Plant Maintenance and Engineering show, which returns to Chicago for the first time in three years, will be held in the International Amphitheater. The Annual Plant Maintenance and Engineering Conference is also set there for the same week. For further information contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

APRIL 14-17—Design Engineering Show and American Society of Mechanical Engineers' Design Engineering Conference will be held in the International Amphitheater, Chicago, Ill. For further information contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 1-8—American Society of Tool Engineers' 1958 Tool Show and twenty-sixth annual convention will be held in Conventional Hall Center, Philadelphia, Pa. For further information contact the Exposition Committee of the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.

MAY 12-16—Southwestern Metal Exposition and Congress, sponsored by the American Society for Metals, will be held at State Fair Park, Dallas, Tex. For further information contact the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. W. H. Eisenman, managing director.

JUNE 9-13—Fourth International Automation Exposition and Congress will be held in the Coliseum, New York City. For further information contact Richard Rumbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.



Automatic

FULL-UNIVERSAL MACHINES for DRILLING–TAPPING–THREADING

Batteries of Snow machines are found in many plants where high production output must be combined with quick set-up, low tooling cost, and the highest degree of accuracy.

A section of the second operation department of the REVERE CAMERA COMPANY is shown where the precision components for REVERE cameras and projectors are processed.

Where "quality" of product is of extreme importance, the decision is to standardize on Snow equipment.

Single Spindle Machines
Two Spindle Machines
Angular Machines
Drilling and Tapping Units
Automatic Jigs and Fixtures
Nut Tapping Machines
Horizontal Machines
Drill Press Tap Heads

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435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

For more information fill in page number on Inquiry Card, on page 233

Complete kit of equipment for maintenance of gage-blocks like the set shown in the center of illustration.

Maintenance Kits for Gage-Blocks

The DoALL Co., Des Plaines, Ill., is now furnishing a complete maintenance kit with all DoALL gage-block sets of thirty-eight pieces or larger at no additional charge. This kit permits the user to conveniently keep the individual blocks clean, rust-free, and burr-free, thus assuring accuracy and long life. As shown in the illustration, the complete kit consists of a black granite-diorite deburring stone, a camel's-hair brush, insulated forceps, a large box of lint-free "wipes," two informative booklets and two Aerosol type containers with specially compounded liquids for gage-block care. One of them is DoALL "Gage Block Preservative" and the other, DoALL "Gage Block Cleaner".

The booklets included with the maintenance kit are a question and answer booklet, "The Facts of Gage Block Life," and one entitled "How to be Your Own Bureau of Standards." The gage-block sets which are packaged with the maintenance kits are sealed in an air-exhausted plastic bag. The bag also contains a package of Silica Jel for moisture protection.

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Annual Index to MACHINERY

The annual index to Volume 63 of MACHINERY (September 1956 to August 1957, inclusive) is now ready for distribution. Subscribers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 93 Worth St., New York 13, N. Y.

° ° °

America's first production V-type, water-cooled, eight-cylinder engine for automobiles appeared in 1914, and was used in the Cadillac models for that year.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233) SHOWING THE OWNERSHIP AND MANAGEMENT

of MACHINERY, published monthly at Bristol, Conn., for October 1, 1957.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 93 Worth St., New York 13, N. Y.; Editor, Charles O. Herb; Managing Editor, Charles H. Wick; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 93 Worth St., New York 13, N. Y.

2. The owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, Harold L. Gray, Clifford Strock, and Suno E. Larson, all of 93 Worth St., New York 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Edgar L. Becker, Nominee for Nancy Jane Becker, Susan Louise Becker, and Donald Louis Becker, 714 Wellington Road, Ridgewood, N. J.; First National Bank of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; David D. Ketchum, 38 Mill Road, Falmouth, Mass.; Lee W. Noyes, Guardian for Susan Yarnall Urban, Greensboro, Vt.; Lee W. Noyes, Trustee under the Will of Robert L. Urban, Greensboro, Vt.; and John T. Urban, 8 Craigie Circle, Cambridge 38, Mass.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Robert B. Luchars and Franklin D. Jones, both of 93 Worth St., New York 13, N. Y.; Ann Pelletier, 116 Pinehurst Ave., New York 33, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

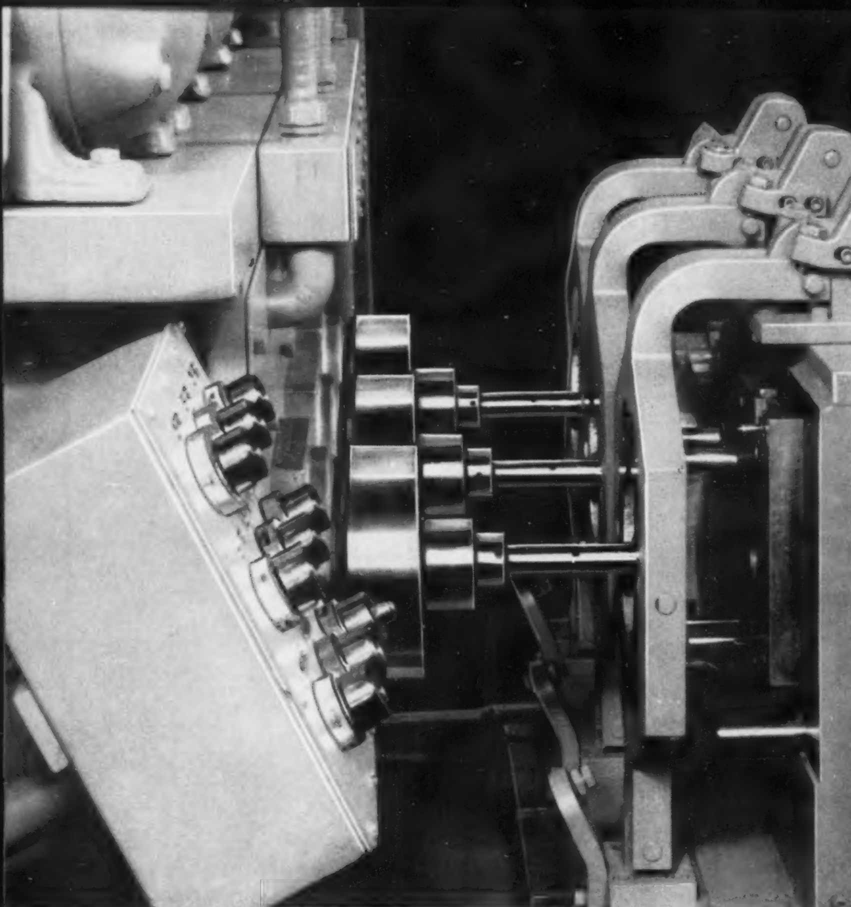
4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDGAR A. BECKER, Business Manager

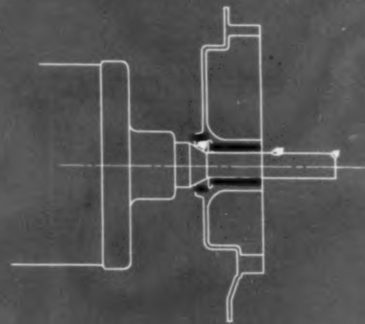
Sworn to and subscribed before me this 19th day of September, 1957. (SEAL).

ALEXANDER LOYKA

Notary Public, State of New York
No. 31-7611350
Qualified in New York County
Commission Expires March 30, 1958



Close-up view of the three-station work fixture. Note hydraulic clamping arrangement.



Heavy lines show cuts made by tools.

Aluminum mounting flanges automatically bored on this Ex-Cell-O Boring Machine.

3 Parts Every 36 Seconds

A large manufacturer of appliance components slashed production costs with a standard Ex-Cell-O Boring Machine. The machine rough and finish bores and counterbores the central holes in aluminum mounting flanges at the rate of *3 parts every 36 seconds!* That's 5 parts per minute!

The machine that performs this operation is the Ex-Cell-O Style 112-D, a hydraulically-operated single-end boring machine. Rugged and versatile, this machine uses one or more spindles for rotation of either the part or tools for accurate boring of a wide variety of medium and large-size parts. With the right tooling, this standard machine can handle both large and small production runs, or can be adapted to a completely automated installation!

This type of machine can make a big difference in your production figures. To find out *how much* difference get a quotation from your Ex-Cell-O representative.

Full view of standard Ex-Cell-O Style 112-D Precision Boring Machine, built for extra production.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

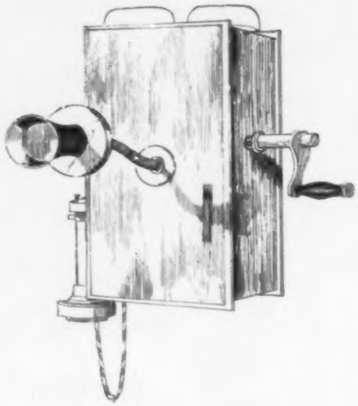
87-19

XLO

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Great in its day...



BUT WOULDN'T YOU
RATHER HAVE THE LATEST
TECHNICAL ADVANCE?

Now...

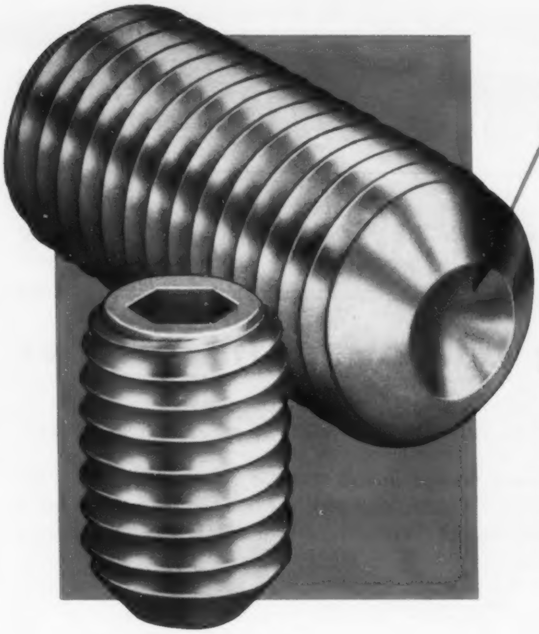
another significant advance in a great tool line

Heller "Job Tempered" Flat Ground Die Steel

Heller's new JOB TEMPERED Flat Ground Die Steel is a truly significant advance in the field.

For one thing, its analysis is recommended by a group of leading consulting metallurgists. For another, it is precision-ground to a smooth surface finish of 25 to 35 micro-inches with all surface defects and decarburization removed to save time and effort in tool making.

It's easy to heat-treat, too. For instance, Heller Oil-Hardening Die Steel will achieve a Rockwell C hardness of 64-65 when hardened within a temperature range of 1450°F. to 1540°F. And a similarly wide range applies to the Air-Hardening type. Simple tempering instructions are supplied with each piece, so the entire heat-treating process is non-critical and virtually foolproof. As a result, you are sure of getting all the benefits of JOB TEMPERED tools, dies, jigs and fixtures when they're made from this superior Heller Die Steel.



ALLENPOINT will give you a bulldog grip at no premium in price!

Allen's scientific redesign of the cup diameter on set screws gives greatly increased resistance to *with-drawal* torque. You can count on Allenpoint Set Screws to stay tighter longer, under heavy strain and vibrations. This dependable premium performance of Allenpoints is yours to use without increasing the cost of manufacturing your products.

Uniform Class 3A Threads

Allenpoints' smooth, uniform threads prevent off-lead conditions like Fig. 1. With Allenpoints, you have full, even contact between the engaging flanks of the threaded members (Fig. 2) —and a tight friction lock over the entire length of the Allenpoint Set Screw.

Fig. 1

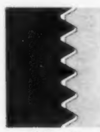
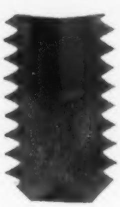


Fig. 2

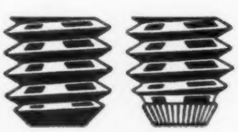
Strong, clean, deep sockets allow full wrenching leverage



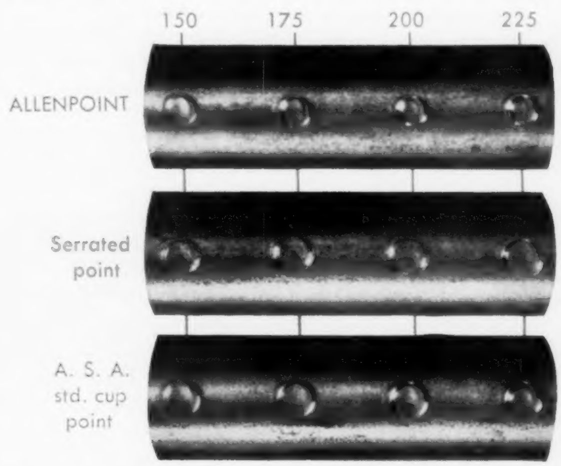
Sockets of Allenpoint Set Screws are cold forged to produce a deeper, smoother socket. No broach chips to interfere with proper seating of the key. This "pressur-forming" preserves the long steel fibers throughout the length of the screw—stronger walls allow maximum tightening torque.

One more full thread on ALLENPOINTS!

Allenpoint Set Screws have one more full thread than serrated point set screws. That means more holding power—especially important when you're using short lengths.



ALLENPOINT's performance compared for you



These actual-size, unretouched photographs show the cup pattern made by Allenpoints, serrated points, and A.S.A. standard cup point set screws in a 3/4″ steel shaft. At each degree of tightening force, Allenpoints make a full circle pattern, penetrating deeper for greater holding power.

We'll be glad to send you more information and samples of Allenpoint Set Screws and other Allen Socket Screw products.

Stocked and sold by leading industrial distributors everywhere

ALLEN MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

ALLEN HEX-SOCKET SCREWS HEAD

For more information fill in page number on Inquiry Card, on page 233

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the tool room and on the production line by the Moore Special Tool Co., Inc., 734 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

Why you should use the Jig Borer and Jig Grinder to inspect their own work

In more than 90 per cent of all cases, the Moore Jig Borer and Jig Grinder provide the most accurate and efficient means for inspecting their own work. The advantages include:

1. Considerable saving of time results from checking the piece in the original setup, *while still in the machine.* In addition, should an error be discovered—the work is *in position for correction.*

2. The same directness which reduced sources of locational error in comparison to toolmaker error also reduces the number of steps and sources of error in inspection.

3. The machine's measuring system is fully as accurate as *any* standard that might be used in its stead. The inspection values, determined by means of this system, are likely to be *more* accurate than those attained by any other shop standard because reorientation errors are eliminated.

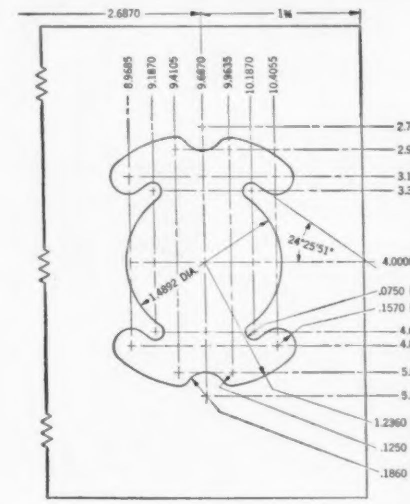
4. The machine spindle provides a rotatable mounting for an indicator. Holes can be picked up directly in this manner, without use of plugs or pins. Out-of-roundness, often mistaken for out-of-location, is easily detected and identified. Full 360° rotation of spindle provides a double indicator reading of any error, thus increasing readability. By vertical movements of the spindle and indicator the shape of the hole can be explored revealing taper, bell-mouth or barrel shape.

5. Contours, one of the most difficult, time-consuming jobs of inspection, can be rapidly and accurately measured and inspected by use of the "indicator measuring" technique. The drawing at the right shows dimensions to be inspected on a complex contour. Of this job it might well be said, "How *else* would you inspect it?"

6. Work jig bored or jig ground to *polar* coordinates on the rotary table can be inspected to *rectangular* coordinates in the same setup. This not only provides a check on possible errors in settings; it eliminates sources of rotary table errors.

7. Paradoxically, the machines will actually inspect somewhat more accurately than they will locate, under most conditions. During inspection, both machine and work are free of vibration, stresses and temperature differentials, so that the accuracy of the measuring system is undiminished.

8. A microscope, interchangeable with the indicator in the machine spindle, can pick up surfaces and small holes which cannot be conveniently reached with an indicator point.



Without modern methods, this contour presents a serious problem to inspect as well as to machine.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new book,* HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts the *modern way.* 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 734 Union Ave., Bridgeport 7, Conn.

For more information fill in page number on Inquiry Card, on page 233

ARROW

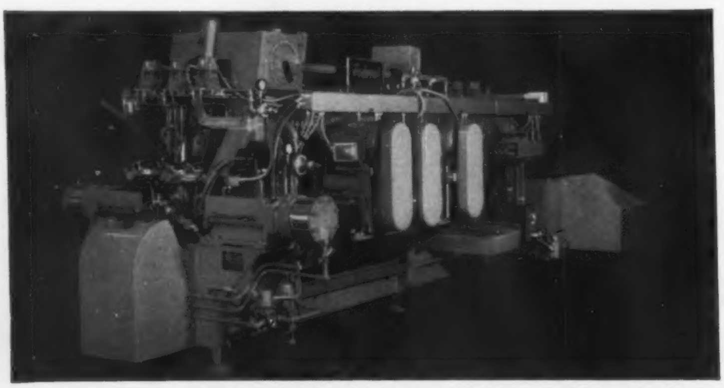
one-source production lines spark interest of volume producers . . .

The prospect of ordering an entire production line, ready made to produce a part to specification, has arrested the interest of many of the nation's top production engineers.

One source responsibility assuring better service; a line 100% harmonic, all stations engineered to work in perfect synchronization; integrated and automated handling of work in process; utilization of common drives and bases, reducing operating costs and floor area, are some of the advantages of the packaged line that has production people talking.

Federal/Warco pioneered the packaged line and have already produced automated lines combining such operations as blanking, forming, drawing, welding, machining, drilling, assembling on a common base.

For additional information contact the Federal/Warco representative nearest you or write direct.



This Federal Packaged Production line welds, spot faces, reams, de-burrs, sets six bolts and welds them in place . . . ejecting finished pedal brackets at a rate of 775 pieces per hour.

Federal / Warco
PACKAGED PRODUCTION LINES

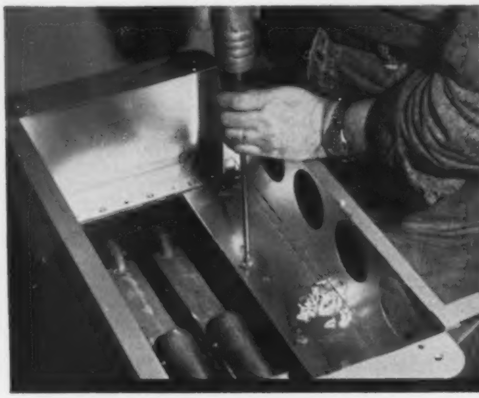
THE FEDERAL MACHINE AND WELDER COMPANY - WARREN, OHIO

422

AFFILIATED WITH BERKELEY-DAVIS, INC., DANVILLE, ILLINOIS, MANUFACTURERS OF AUTOMATIC ARC WELDING EQUIPMENT.

For more information fill in page number on Inquiry Card, on page 233

Investigate the assembly savings made possible by P-K® self-tapping screws



Because P-K Type A Self-tapping Screws have clean, deep slots and sharp gimlet points . . . and because they are consistently uniform, Reznor Mfg. Co. enjoys important savings in the assembly of their gas heaters.

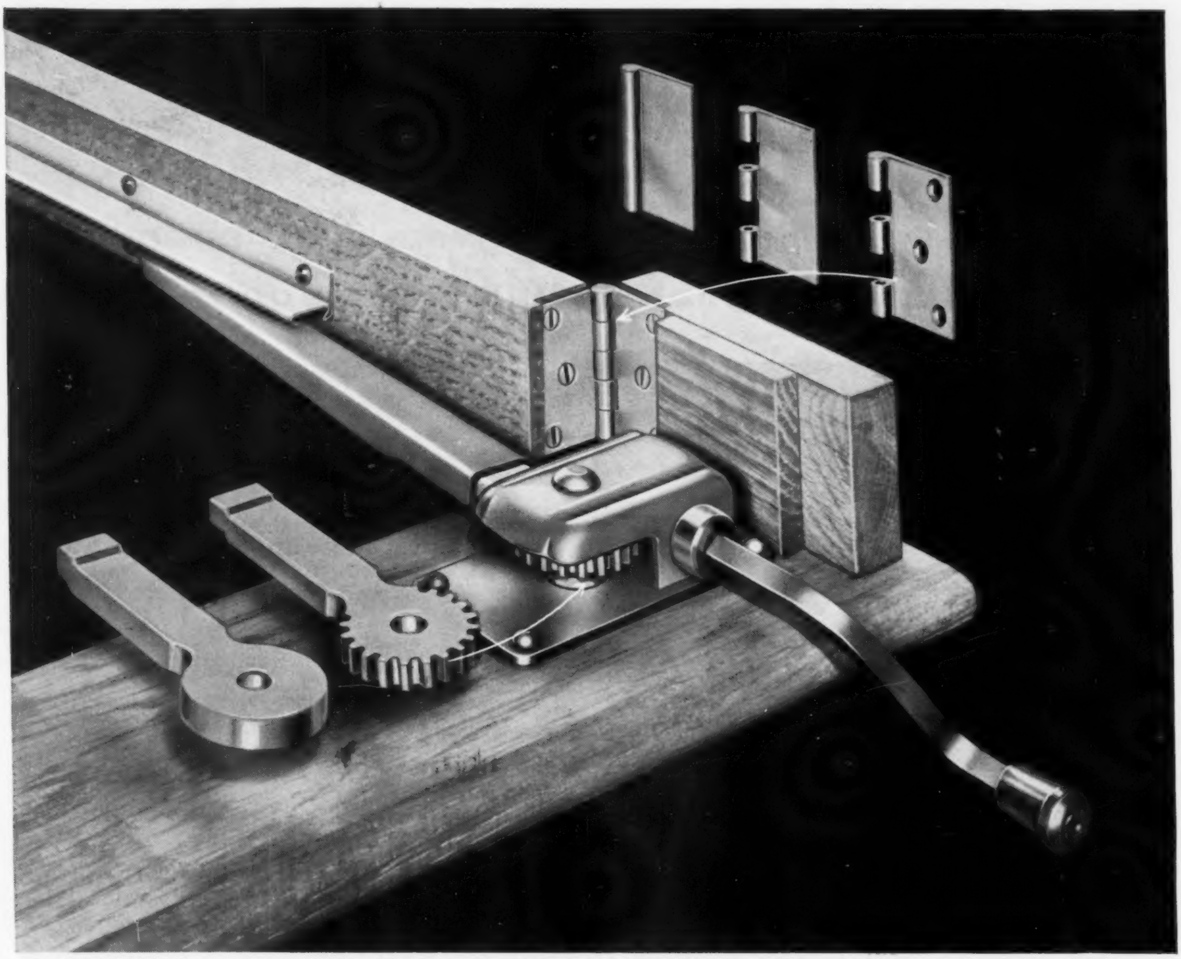
To hold the plastic handle halves of their Instant Heat Soldering Irons together, The Lenk Mfg. Co. specifies P-K Type F Self-tapping Screws. No need for a separate tapping operation. Production is increased and costs reduced—thanks to P-K Screws.

Melnor Industries, Inc. (formerly Melnor Metal Products Co.) puts assembly strength into their famous "Swingin' Spray" oscillating lawn sprinkler by fastening zinc and aluminum parts with P-K Self-tapping Screws — 7 Phillips Head Type Z and 18 Type F. They start right . . . drive right . . . and stay tight.

PARKER-KALON DIVISION, General American Transportation Corporation Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws

PARKER-KALON® fasteners

Sold Everywhere Through Leading Industrial Distributors
Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California



DEMONSTRATION UNIT for the Casement Window Operator, a product of The H. S. Getty & Company, Inc., subsidiary of Trans Continental Industries, Inc. At left on sill is Anaconda Die Pressed Forging for the operating arm gear. To its right is the finished part after trimming operations around circumference of gear head and in the hole—and hobbing teeth in. Upper right: hinge blank cut from long mill length of an Anaconda Extruded Shape – blank with slots milled and pinholes drilled in knuckles – finished hinge leaf.

How Anaconda die pressed forgings and extrusions cut costs for Getty*

Forgings save 30%. The H. S. Getty & Company, Inc., Philadelphia, is a leading manufacturer of marine, window and builders' hardware. They used to fabricate the operating arm gear for their casement window operator (above) from a leaded sheet brass stamping. The American Brass Company suggested a switch to die pressed forgings. Getty tried it, doing a trimming operation in the hole and periphery of the head – then hobbing in the teeth. Metal saving on each unit was 7 ounces. Machining was cut 10% – for an over-all saving of 30%.

Extruded shapes cut machining and finishing. The illustrations above right show the steps in fabricating Getty butt hinges from an Anaconda extruded shape. This short cut to a superior product gave Getty a simplified shop production routine that eliminated several costly machining and finishing operations – because the extruded shape has the exact cross section of the finished hinge. And, because of the dimensional accuracy of extruded shapes, each part is readily adaptable to drill jigs and milling fixtures. These precision hinges will perform well, too, because extruded metal is *wrought* metal – tough, strong, and dense-grained.

Find out how Anaconda short cuts can help you. If the production possibilities of die pressed forgings or extruded shapes look promising to you, send us a sketch, sample, or description of each part you have in mind. We'll be glad to tell you about costs – and about possible savings, too. Address: The American Brass Company, Waterbury 20, Connecticut. 5773

*Subsidiary of Trans Continental Industries, Inc.

ANACONDA®

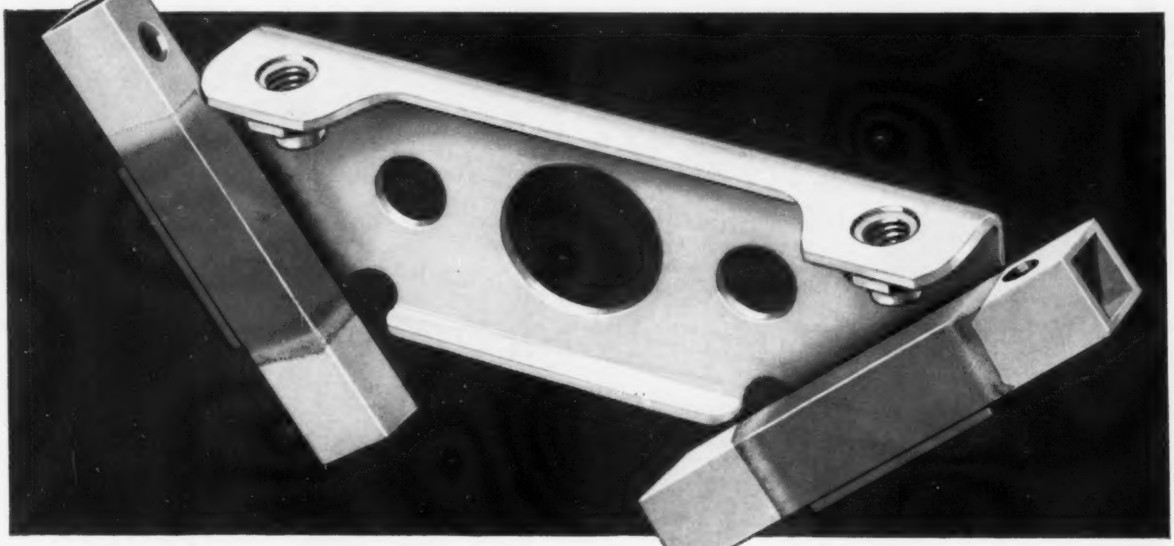
DIE PRESSED FORGINGS
EXTRUDED SHAPES

MADE BY THE AMERICAN BRASS COMPANY

For more information fill in page number on Inquiry Card, on page 233

Jack & Heintz Saves $15.84 Per Hour...

with TOCCO* *Induction Brazing*



Brazing Costs Down—When Jack & Heintz engineers switched from torch brazing to automatic induction, brazing cost of these inverter brush mounts fell from \$.05 to \$.006 each—a reduction of 83% in direct labor costs alone! Additional savings result because less cleaning is required after TOCCO, and fuel costs are much lower, too.

Brazing Production Up—While costs dropped, production on the part zoomed—from 40 to 360 brazed assemblies per hour. Furthermore, rejects and scrap, formerly high, are now negligible.

Versatility—The part shown is just one of over 25 parts, large and small, which alert J & H engineers have converted from old-fashioned brazing methods to modern, automatic TOCCO. Overall brazing costs (TOCCO brazing versus former methods used) are down 75%—brazing speed, up 100%.

If the manufacture of your product involves brazing, heat-treating, forging or melting of ferrous or non-ferrous metals, don't overlook TOCCO as a sound method of increasing produotion, improving product quality and slashing costs.

TOCCO

JUST PUSH A BUTTON

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. M-12, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering"

Name________

Position________

Company________

Address________

City________ Zone____ State____

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This is a typical boring set-up. Counterboring and trepanning tools give equally efficient results.

SHELL GARIA OIL 115 specified for

LeBLOND-CARLSTEDT RAPID BORER

. . . the machine that produces deep holes 3 to 8 times faster

The manufacturers of this new concept in deep hole boring say that the Rapid Borer was developed expressly to accommodate revolutionary new tooling which drills, bores and trepans at high speed with accuracy, and gives excellent finish. Cutting oil is forced between the boring bar and wall of stock, forming a continuous bearing. The oil is forced back through a hollow boring bar, carrying away the chips as it goes. Tool faces are kept clean and chip passage clear. Chips do not come in contact with finished bore.

To insure the success of this operation, a special cutting oil with extreme pressure and excellent cooling characteristics was required. Shell Research went to work, and out came a new addition to the Shell family of cutting oils . . . Garia® Oil 115.

If you are interested in more technical information on Garia Oil 115, write Shell Oil Company, 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

SHELL GARIA OIL 115

SHELL

For more information fill in page number on Inquiry Card, on page 233

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., Morton Grove, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Disc
Carborundum Co., Niagara Falls, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., Morton Grove, Ill.

ACCUMULATORS, Hydraulic
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic —Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.

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ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

AUTOMATION EQUIPMENT
Wilson Automation, P.O. Box 3855, Detroit 5, Mich.

BABBITT
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BALANCING EQUIPMENT
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES
New Departure Div., Bristol, Conn.

BALLS
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Haynes Stellite Co., Kokomo, Ind.
Kennametal Inc., Latrobe, Penna.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Fafnir Bearing Co., New Britain, Conn.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo Ohio
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

BEARINGS, Needle
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS
South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BENDERS, Plate, Etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BENDING ROLLS
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Pangborn Corp., Hagerstown, Md.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT
Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BOLTS, NUTS AND SCREWS
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Kennametal Inc., Latrobe, Penna.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

(Continued on page 286)

Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Canton Tool Mfg. Co., E. Canton, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford ,Ill.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti, Milan, Italy.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridegport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., 285 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridegport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 2, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegon, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

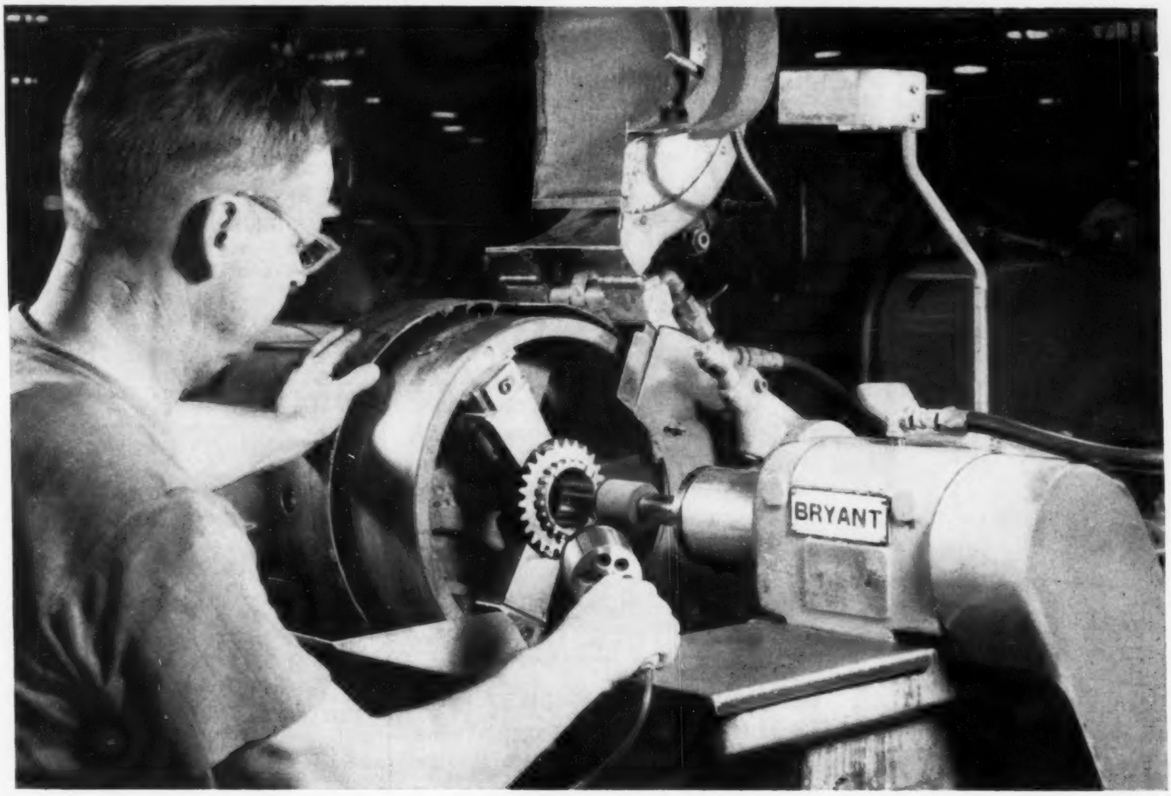
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridegport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.



Q. **Why does Dana Corp., Toledo, Ohio, use eight Bryant 3216 Internal Grinders?**

A. **"The Bryant 3216 produces more parts for less money . . . gives better quality than manually operated machines . . . holds size consistently and finishes better."**

The Toledo Division of Dana Corp., specializes in making a great variety of parts: transmissions, universal joints, propeller shafts, forgings, gear boxes and torque converters, to name only a few.

In the words of a company official, Dana is "a sort of glorified jobbing shop . . . our runs are comparatively short, and quick changeover ability is a key factor in our operation."

At Dana, the Bryant 3216 Automatic Internal Grinder has proven superior to other makes. The company first bought four 3216's, and then, because of their excellent performance, bought four more.

Here are some of the things Dana likes about Bryant 3216's: —

"they're economical . . . we're able to have one man run two machines, and cost is cut to about 60% of single-machine operation."

"the 3216 holds size consistently and finishes better."

"holds tolerance very well . . . you can depend on it to do the job it is supposed to do."

"there is almost no maintenance . . . these machines have run trouble-free since we've had them."

"simple to operate . . . easy to adjust . . . hold close tolerances . . . meet all our requirements."

Learn how the Bryant 3216 Automatic or other Bryant machines can help *you* in your internal grinding operations. Write today for literature.

BRYANT Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

For more information fill in page number on Inquiry Card, on page 233

BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel

Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal

American Crucible Products Co., Lorain, Ohio.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

Machine Tools And
Power Transmission Equipment
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.
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STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.

CABINETS, Tool
Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES
American Schiess Crop., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
American Crucible Products Co., Lorain, Ohio.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Dow Chemical Co., Midland, Mich.
Mueller Brass Co., Port Huron 35, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

Automatic feeding and setting with...

T-J

Speeds up riveting and clinching!

It's a quick step to *faster assembly* and *reduced labor costs* when you put T-J Rivitors and Clinchors in your production picture! These performance-proved machines are suited to a wide range of assembly jobs for aircraft, automotive, farm machinery riviting jobs of all kinds.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to 7/8" long. Throat depths 8" to 36".

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

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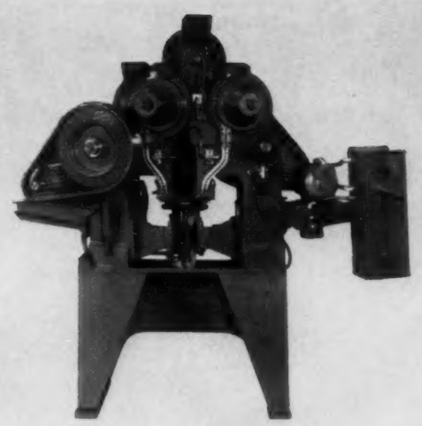

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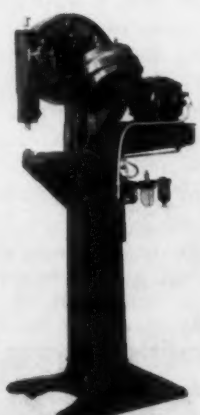
SPECIAL TWIN RIVITOR! Tooled for 6 station indexing fixture, incorporating automatic clamping and ejecting mechanisms, for riviting laminated armature assemblies.



T-J CLINCHOR adaptable to a wide range of clinch nut setting problems. Gravity feed model shown here.

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CASTINGS, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave. Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTER-DRILLING MACHINES

Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Improved Machinery, Inc., Nashua, N. H.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket. R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt
Wadell Equip Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Jacobs Mfg. Co., West Hartford 10, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Universal Three-Jaw

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless

Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment Spacing Equipment

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Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Fawick Corp., Cleveland, Ohio.
Minster Mch. Co., Minster, Ohio.
Rockford Clutch Div., Rockford, Ill.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air

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Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Sheffield Corp., Box 893, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

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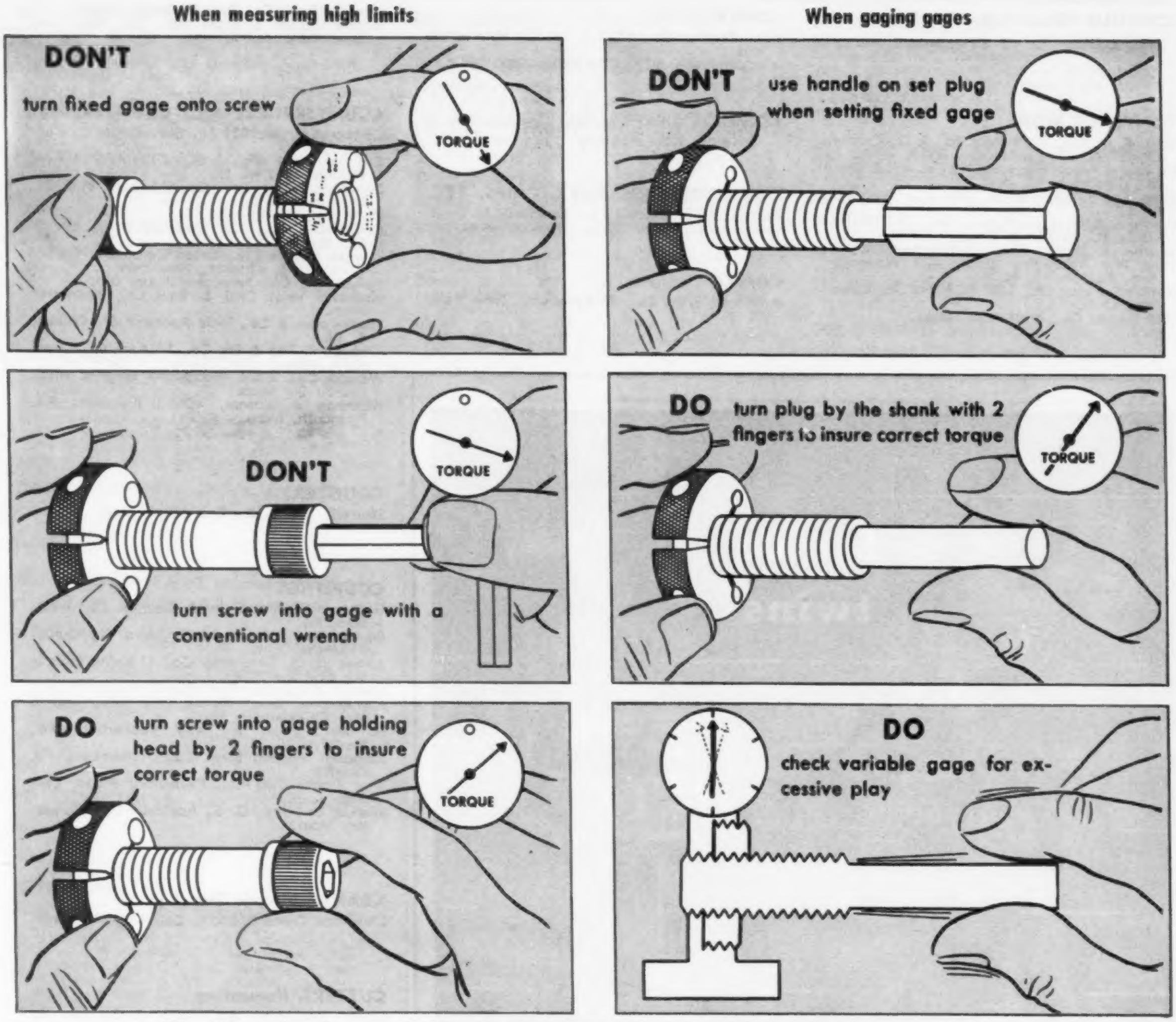
DoAll Co., 54 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 1, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.



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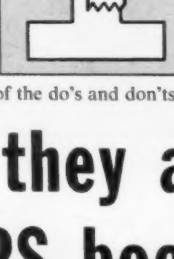

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co., Watertown, Mass.

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Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G Sts., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
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du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
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Onsrud Machine Works, Inc., Niles, Ill.
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Cone Automatic Mch. Co., Windsor, Vt.
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Modern Machine Tool Co., Jackson, Mich.

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DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

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Thompson Products, Inc., Warren, Mich.
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Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
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Wales-Strippit Co., Akron, N. Y.

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DIE STOCKS—See Stocks and Dies

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Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
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DIVIDING HEADS—See Indexing and Spacing Equipment

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DRAWING COMPOUNDS

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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National Automatic Tool Co., Richmond, Ind.
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Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

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Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
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(Continued on page 300)

For more information fill in page number on Inquiry Card, on page 233

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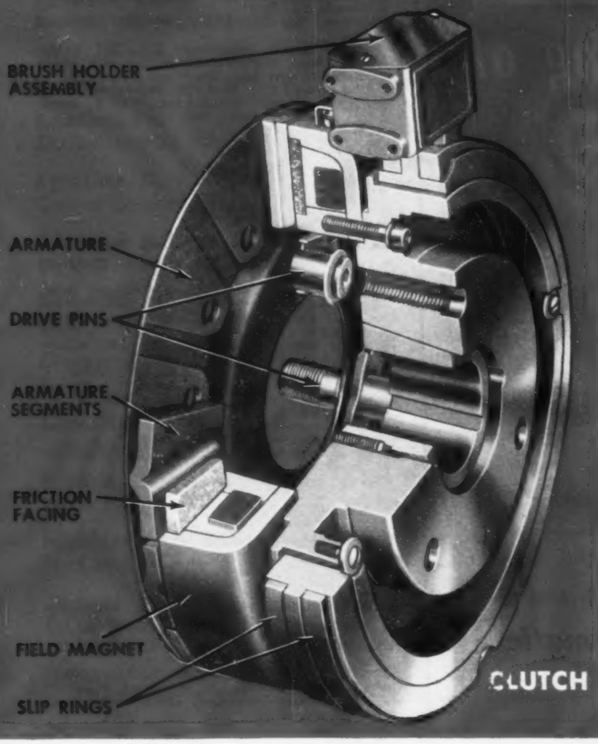

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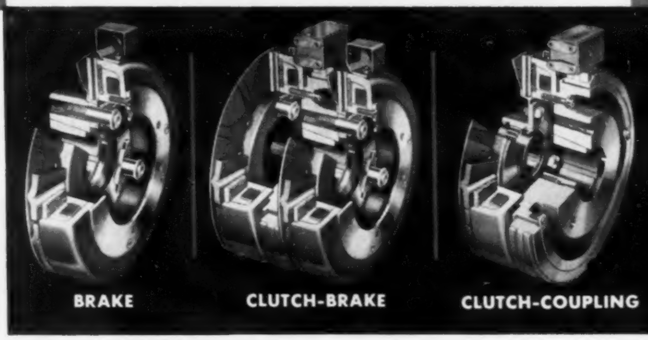
Ask us to tell you how these Dyna-torQ units will fit your equipment.



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Western Machine Tool Works, Holland, Mich.
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Cross Co., 3250 Bellevue, Detroit 7, Mich.
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Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
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Le Maire Tool & Mfg. Co., Dearborn, Mich.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
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Wales-Strippit Corp., Akron, N. Y.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
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Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
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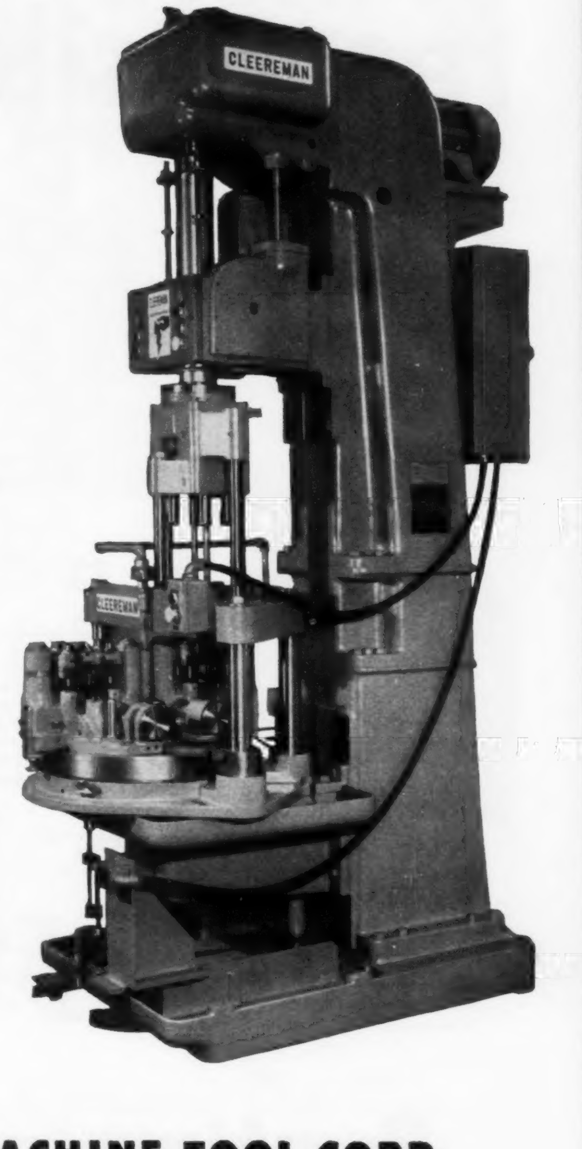

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Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
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Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
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National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., Akron, N. Y.
Western Machine Tool Works, Holland, Mich.

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Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleereman Machine Tool Co., Green Bay, Wis.
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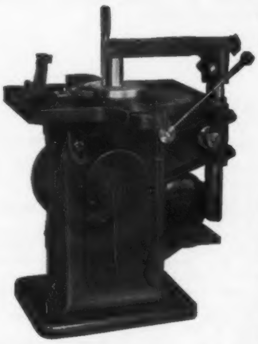

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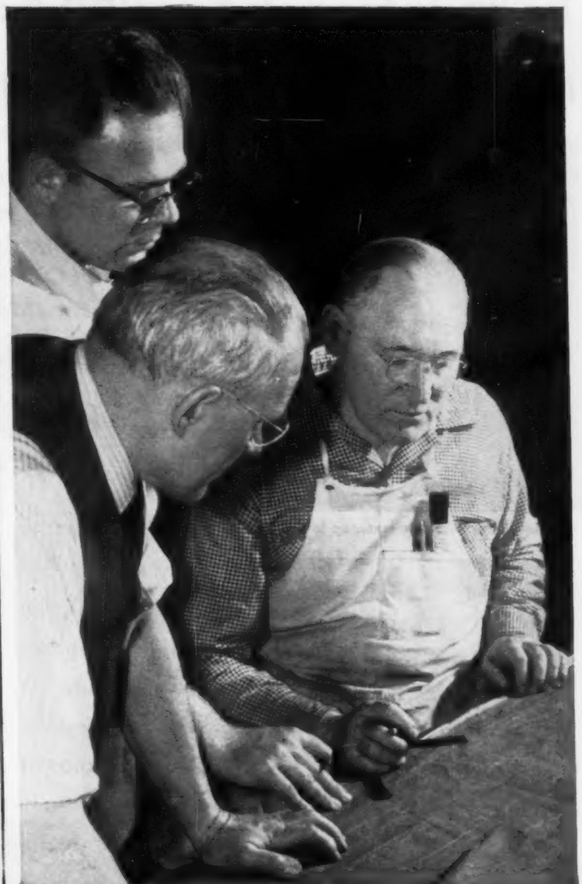

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DoAll Co., Des Plaines, Ill.
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Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
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DoAll Co., Des Plaines, Ill.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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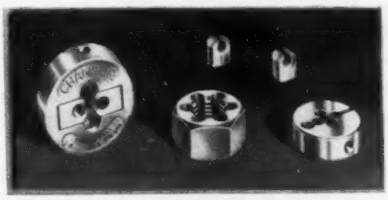
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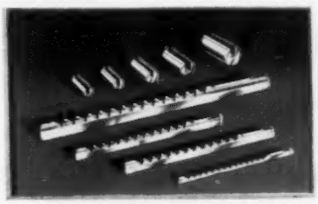
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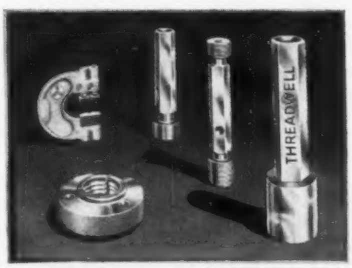

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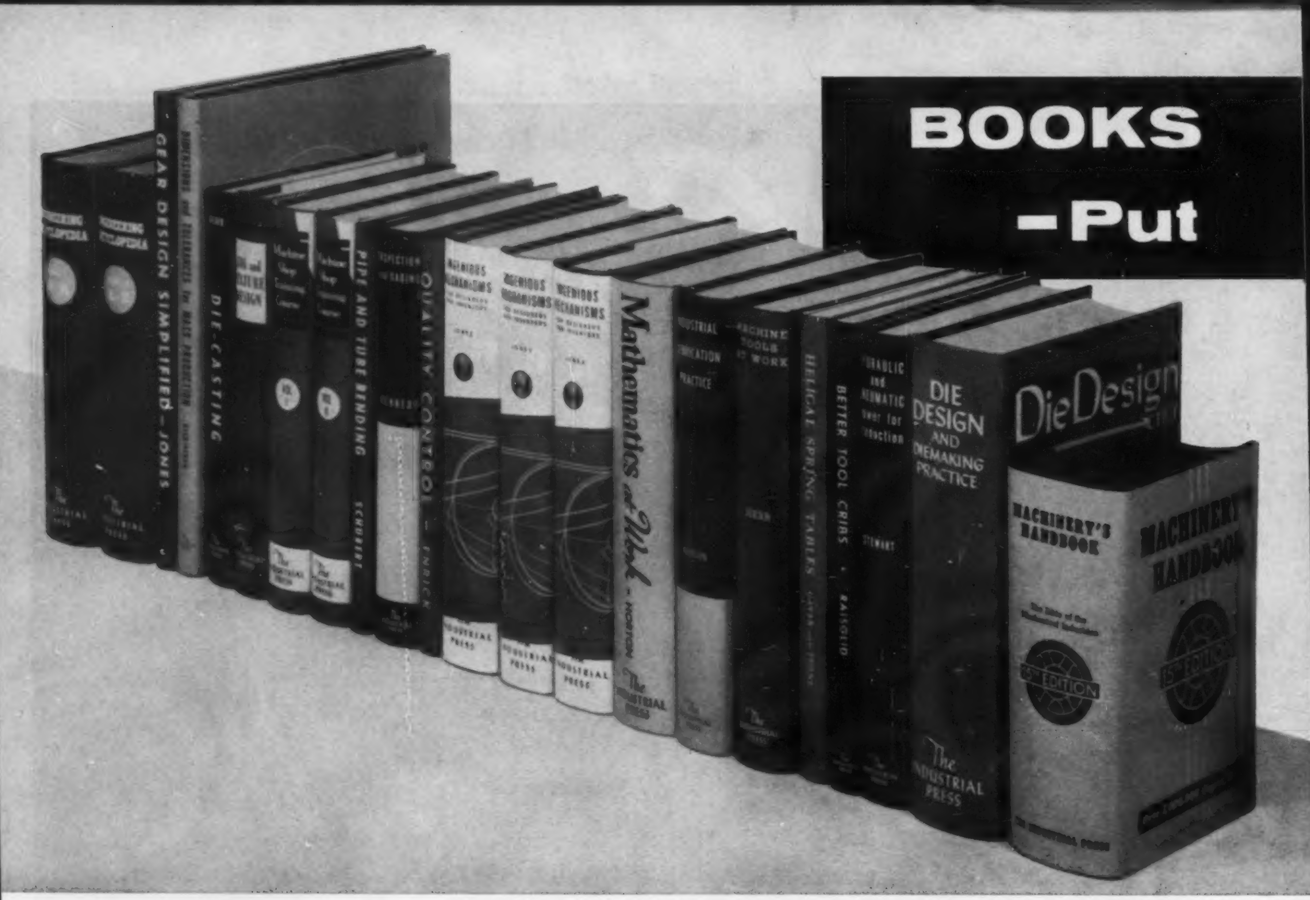

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Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St, Providence 1, R I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.
Ames. B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES Electric Comparator
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness
Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.

(Continued on page 316)

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Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic

Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett Co., L. S., Athol, Mass.

GASKETS

Garlock Packing Co., Palmyra, N. Y.

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Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Layfayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel and Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

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GEAR LAPPERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 2, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
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GEARS, AND GEAR BLANKS, Nonmetallic

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.

Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Ryerson, Jos. T. & Son., Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut

Automotive Gear Works, Inc., South 8th & O St., Richmond, Ind.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburg & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Perkins Machine & Gear Co., W. Springfield, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
South Bend Lathe Works, South Bend 22, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

GRINDERS, Carbide Tool

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill

Kearney & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River, Cincinnati 4, Ohio
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Hamco Machines, Inc., 93 Mt. Hope Ave., Rochester 20, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

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Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Cylindrical

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.

Mattison Machine Works, Rockford, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Aaron Machinery Co., Inc., 45 Crosby St., New York 1, N. Y.
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Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
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Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Surface Reciprocating

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

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Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J
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Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Mackin Co., Jackson, Michigan
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.

GROOVING TOOLS, Internal

Kennametal Inc., Latrobe, Penna.
Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

HARDENING FURNACES

Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEAT-TREATING EQUIPMENT—See Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HONING MACHINES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY
Tools and equipment

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

(Continued on page 324)

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Austin Industrial Corp., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morris, Robert E. Co., W. Hartford, Conn.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch., 3640 Main St., Springfield 7, Mass.
Wadell Equip. Co., Clark, N. J.
Western Machine Tool Works, Holland, Mich.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, L. S., Co., Athol, Mass.

INDICATOR LIGHTS—See Lights, Indicator

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co. 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th-N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The, L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INSPECTION EQUIPMENT, Ultrasonic

Curtiss-Wright Corp., Caldwell, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

JACKS, Planer—See Set-up Equipment

JIG BORERS

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cleereman Machine Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
M. B. I. Export & Import, Ltd., 475 Grand Concourse, New York 51, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2 N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIGS AND FIXTURES

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Metal Carbides Corp., Youngstown 12, Ohio
Modern Industrial Engrg Co., 14230 Birwood Ave., Detroit 28, Mich.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
Morton Mfg. Co., Muskegon Hts., Michigan

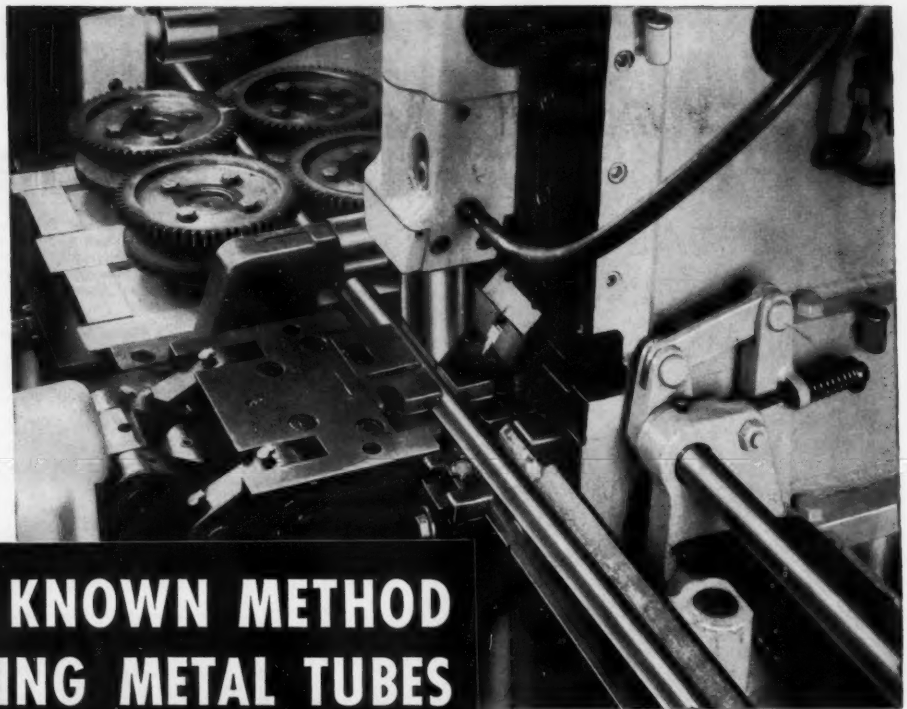
KNURLING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350 Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9 Ohio

(Continued on page 328)



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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating—See Lathes, Duplicating

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Pilot Div., Cone Automatic Mch. Co., 30 Rockefeller Plaza, New York, N. Y.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Engine, Manufacturing

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Eustacchio, S., Brescia, Italy
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

(Continued on page 330)

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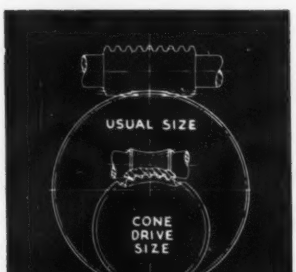

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Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Engine, Toolroom

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kiskwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Western Machine Tool Works, Holland, Mich.

LATHES, Gap

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
LeBlond, R. K., Mch Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio

Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4 Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
New Britain Mch. Co., New Britain Gridley Div., New Britain, Conn.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

LEVELS

Lufkin Rule Co., Saginaw, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., Niles, Ill.

MACHINERY, Used and Rebuilt

Eastern Mchry. Co., 1000 Tenessee Ave., Cincinnati, Ohio
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Van Keuren Co., Watertown 72, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

MACHINISTS' SMALL TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear

Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROMETER HEADS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

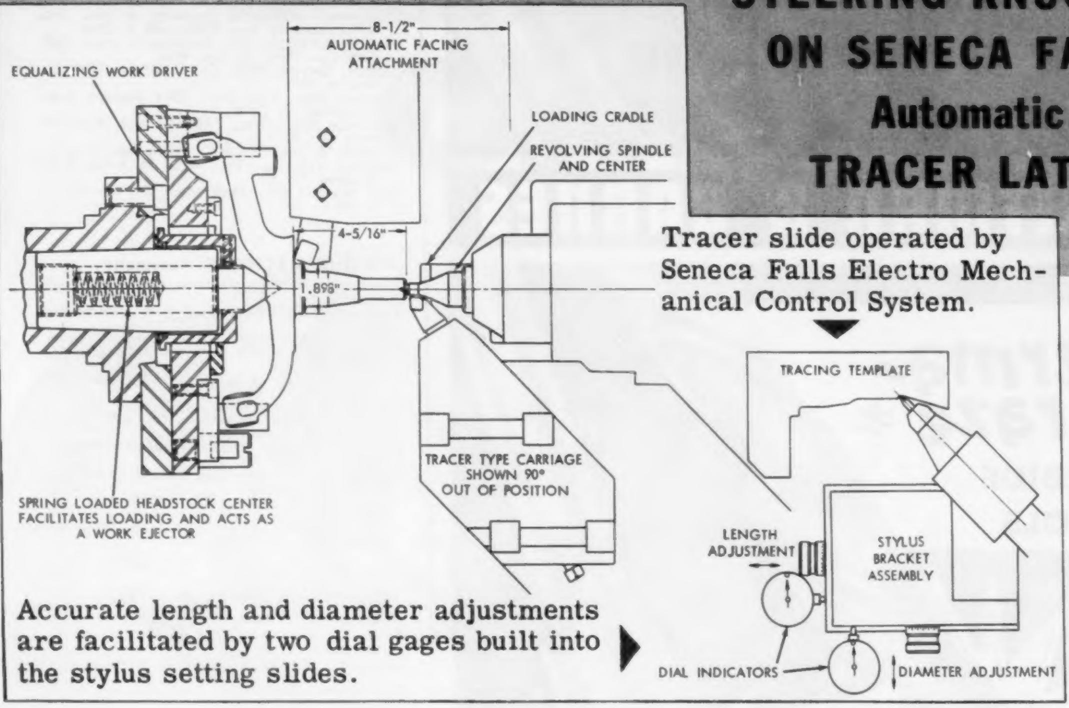
MICROMETERS, Outside, Inside, Depth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'

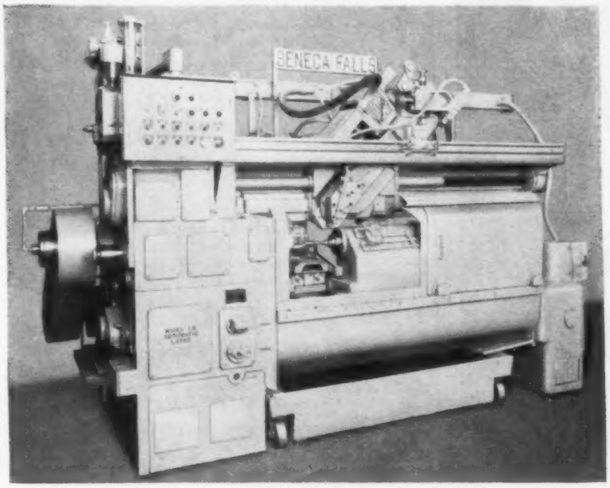
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SIMPLIFIED TOOLING CUTS COST OF MACHINING STEERING KNUCKLES ON SENECA FALLS Automatic TRACER LATHE



Tracer slide operated by Seneca Falls Electro Mechanical Control System.

Accurate length and diameter adjustments are facilitated by two dial gages built into the stylus setting slides.



SENECA FALLS MODEL LQ Automatic TRACER LATHE

Two cutting tools generate the form required. The rear tool removes excess material from the flange face in a coarse-feed, roughing cut. The tracer-controlled tool finish turns both the stem end and flange face. The two carbide inserts may be indexed or rotated to provide new cutting points in a matter of seconds. Tool setting is practically eliminated!

Work handling time and operator fatigue also have been reduced. The operator places the work piece on the spring-loaded head center with the stem end resting on a Vee-shaped loading cradle at the tailstock. The piece is then rotated clockwise until the arm is in contact with a spring stop on the driver. An air valve operating the tailstock quill is then opened, pushing the piece and the head center back against a solid stop and into driving position.

Spindle speed is electronically controlled to provide a constant cutting speed over the stem diameters and the face of the flange—thus assuring maximum production with optimum tool life and finish.

Get the facts on this newest Seneca Falls Lathe.

SENECA FALLS MACHINE

ENGINEERED FOR PROFIT

SENECA FALLS MACHINE CO.

SENECA FALLS, NEW YORK

Lo-swing Lathes and Seneca Falls Machine Tools, Automation and Electronics

MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Morris, Robert E. Co., W. Hartford, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Morris, Robert E. Co., W. Hartford, Conn.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Arrow Engineering Co., Inc., 120 E. Market St., Indianapolis, Ind.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Colonial-Romulus Div., Parkgrove Station, Detroit 5, Mich.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Mich. 1830 Stephenson Highway, Royal Oak 3, Mich.

(Continued on page 334)

For more information fill in page number on Inquiry Card, on page 233

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Onsrud Machine Works, Inc., Niles, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Ferndale, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morris, Robert E. Co., W. Hartford, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2. N. J.

MILLING MACHINES, Knee Type Ram

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Excange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.

MOLDING MACHINES, Plastic

Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

MOTORS, Air

Ingersoll-Rand Co., Phillipsburg, N. J.

MOTORS, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

Barnes, J. S., Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.

National Automatic Tool Co., S. 7th N. Sts., Ave., Detroit 7, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Richmond, Ind.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES

Fenway Machine Co., Inc., Willow Grove, Penna.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Wales-Strippit Corp., Akron, N. Y.

NICKEL AND NICKEL ALLOYS

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co. (Tubular Prod. Div.), Beaver Falls, Penna.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld

Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

PIPE THREADING AND CUTTING MACHINES

Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Machine Co., Inc., Waynesboro, Pa.

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.

PLASTICS AND PLASTIC PRODUCTS

Dow Chemical Co., Midland, Mich.
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

PRESS FEEDER, Automatic

Bliss Co., E. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Alva Allen Industries, Clinton, Mo.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Colonial Broach & Machine Co., Box 37, Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

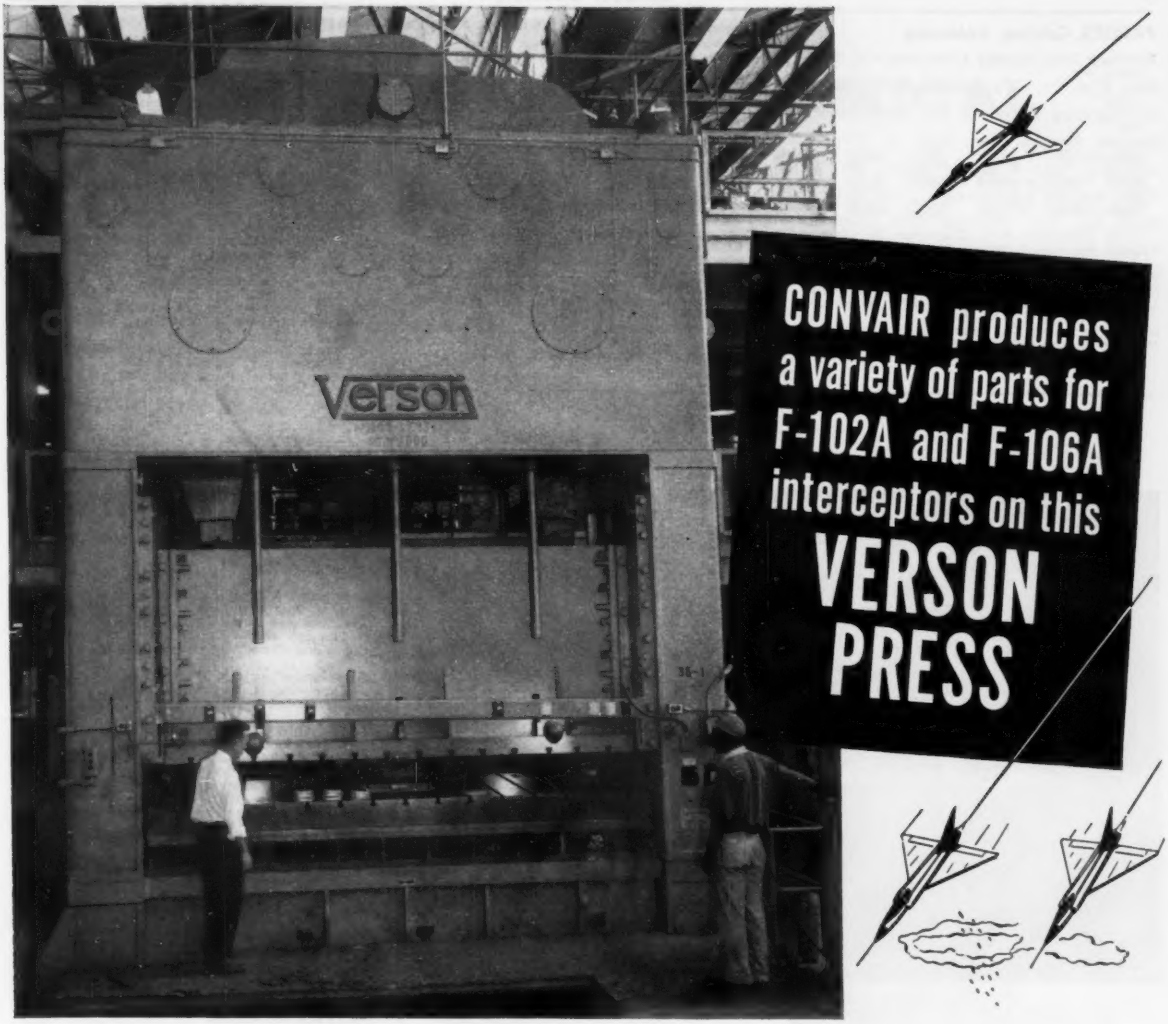
Alva Allen Industries, Clinton, Mo.
Alpha Press & Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bath, Cyril Co., 32324 Solon Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., 1745 Overland Ave. N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 55 N. 18th St., East Orange, N. J.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.



At Convair's San Diego Plant II, this 1000 ton Verson Eccentric Press proves its versatility daily by blanking and forming a variety of sheetmetal parts for Convair's F-102A and F-106A interceptors.

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PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Mo.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

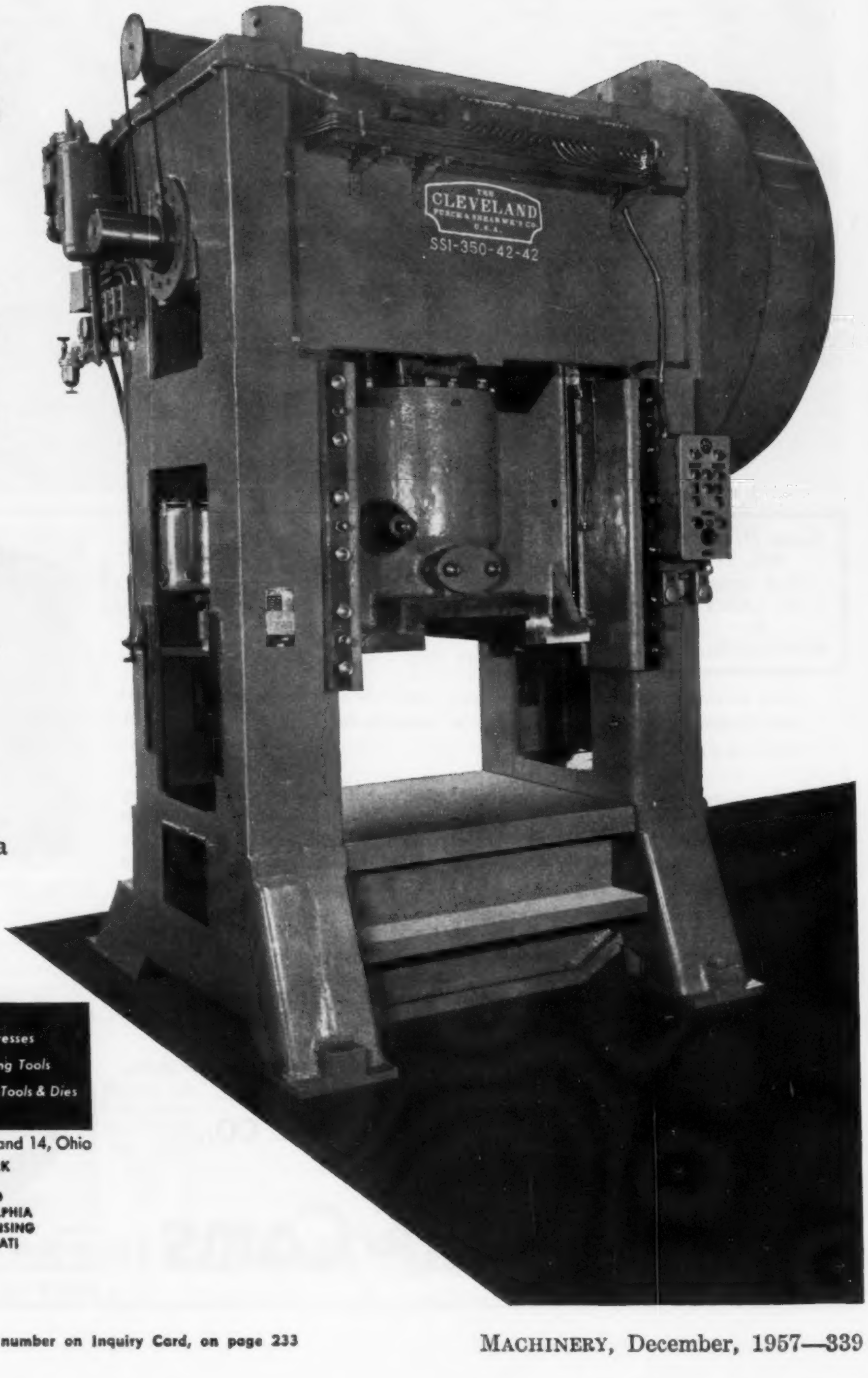
PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.

(Continued on page 340)

4 OF THESE ECONOMICAL CLEVELAND PRESSES

newly installed— now on FULL TIME production of 1958 automobile parts!



One of the leading automobile manufacturers recently added *four* of these Cleveland Single Crank Presses to boost production of parts for their 1958 line of cars.

Designed for uninterrupted production with every important cost-reducing and safety feature, these new 350-ton-capacity presses have a stroke of 3″, a shut height of 22″, a bed area of 42 x 42″, and operate at 60 rpm.

If production and economy are your problem, let us send you complete details on the improved performance of Cleveland Presses. You have eleven different types of presses to choose from, each of which can be furnished in a wide range of sizes and capacities to suit your particular requirements.

THE CLEVELAND PUNCH & SHEAR WORKS CO. U.S.A.
Established 1880

Power Presses
Fabricating Tools
Punching Tools & Dies

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

Offices: NEW YORK, DETROIT, CHICAGO, PHILADELPHIA, EAST LANSING, CINCINNATI

AA-6686

For more information fill in page number on Inquiry Card, on page 233

Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Notching

Alva Allen Industries, Clinton, Mo.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Alva Allen Industries, Clinton, Mo.
Bath Cyril Co., 32324 Aurora Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

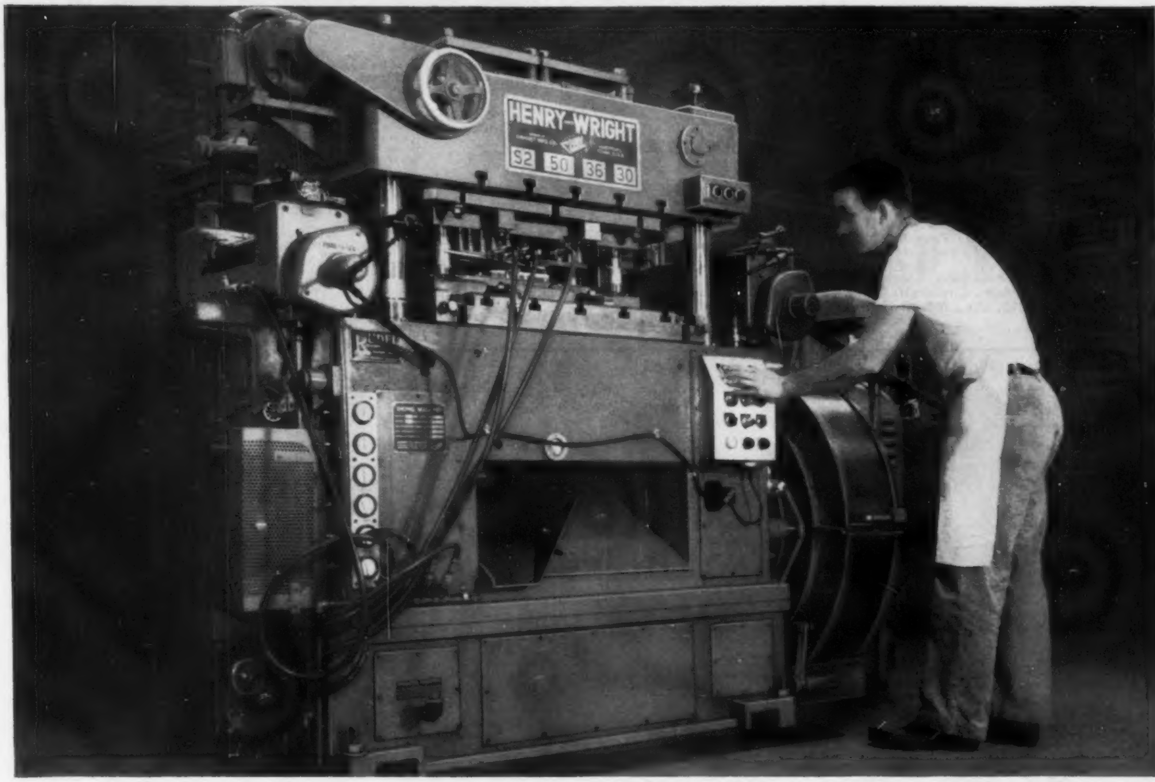
Alva Allen Industries, Clinton, Mo.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

Another Outstanding Henry and Wright Installation . . .



Henry & Wright 50-ton Double Crank at Electric Typewriter Division, International Business Machines Corporation, Kingston, N. Y.

IBM took these steps to assure quality stamping methods

Assure quality and reduce problems inherent in separate operations by using progressive dies for key components . . . design dies so as to accommodate sub-dies for variations in a part's configuration . . . build each die to the highest standards of precision . . . use presses of exceptional accuracy to assure maximum die life.

Double Crank Henry & Wrights were selected for this program. The pay-off: 180,000 type bars produced between die grinds as against half that number with old dies on conventional press; 8,000 trip levers per hour on a Henry & Wright against 5,000 per hour by the previous method.

Operational benefits cited by IBM personnel included: after a year's use, Henry & Wrights retained parallelism-alignment within .0005"; front and back accessibility of machines reduces die set-up time; misfeeding of stock eliminated; feed length variation is negligible, thereby making adjustments unnecessary to compensate for changes in press speed; punch clamping is easier.

To be sure of the maximum pay-off for improved methods in your plant, investigate Henry & Wrights. Catalogs are yours for the asking.

Now, more than ever before, there's an H-P-M for your particular job. Write today for complete information. Make H-P-M your standard for metalworking press equipment.

HPM

H802

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U.S.A.

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PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R. Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers' Taper, Shell, Adjustable, etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REELS, Stock

National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnaces

Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, etc.

Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

RIVETERS, Portable

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

RIVETERS, Stationary

Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

RULES, SCALES AND STRAIGHTEDGES—See Machinists' Small Tools

RUST INHIBITORS

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular, Friction

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Tannewitz Works, Grand Rapids, Mich.

SAW BLADE SHARPENERS

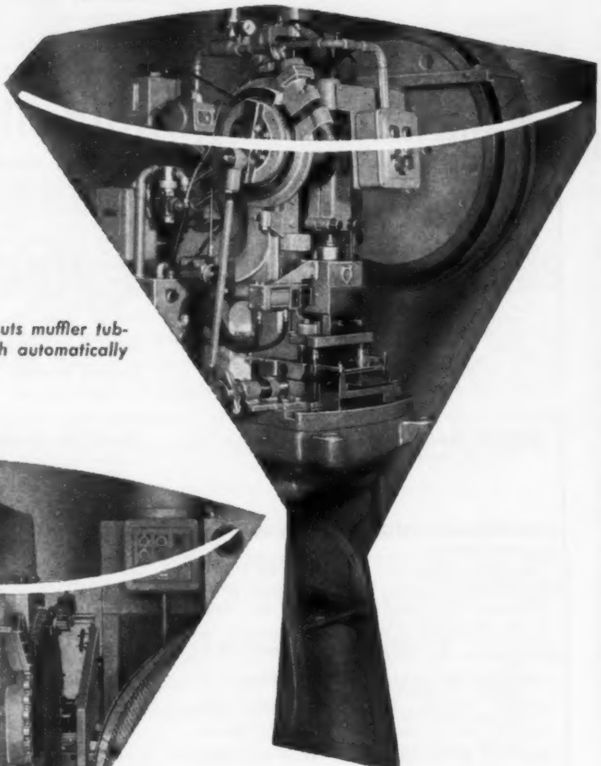
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

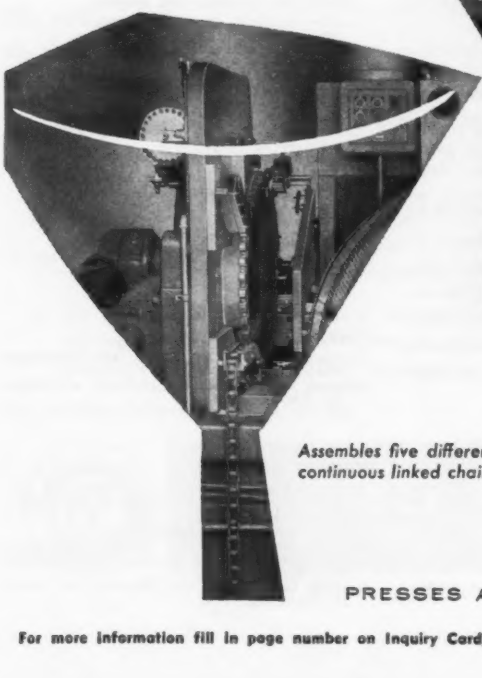
FUNNEL TO SAVINGS IN HANDLING AND MOTION

COMBINED OPERATIONS ON V & O EQUIPPED PRESSES

Stamps out fins in progressive die, then stacks them onto tubes



Feeds and cuts muffler tubing to length automatically



Assembles five different parts into continuous linked chain, spins rivet

Each of the above units (designed and built by V & O) "funnels" two or more operations into an integrated system of parts production. Eliminated are such intermediate tasks as materials-handling between machines, hand-placing of partly finished pieces in dies, and separate inspections of parts in process.

All three units are based on standard types of V & O presses. Even the chainmaking press, which is on its back to facilitate tool operation, follows a precedent well-established by V & O. Of equal importance is the fact that V & O presses are especially designed for combined operations. Featuring long slide precision, they have the accuracy, sturdiness and adaptability essential to long die life and smoothly functioning feeds and attachments.

Remember, too, that we probably have more experience in equipping presses for automatic methods than anyone else. We have been doing it since 1889. Why not put this experience to work now—it can mean important cost reductions in your production operations.

THE V & O PRESS COMPANY

Division of Emhart Mfg. Co.

341 UNION TURNPIKE, HUDSON, NEW YORK

PRESSES AND METHODS THAT AUTOMATICALLY REDUCE COSTS

For more information fill in page number on Inquiry Card, on page 233

SAWING MACHINES, Band
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., Kenosha, Wis.
Tannewitz Works, Grand Rapids, Mich.

SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Racine Hydraulics & Machinery Inc., Racine, Wis.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

SAWS, Screw-slotting—See Cutters, Milling

SCALES
Hydroway Scales, Inc., 31302 Stephenson Hwy., Madison Hts., Mich.

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Air Tools, P. O. Box 2119, Houston, Texas
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Errington Mech. Lab, Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS, Oil or Grease
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Cihcago, Ill.
Challenge Mchry. Co., Grand Haven, Mich.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAPERS, Crank and Hydraulic
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Western Machine Tool Works, Holland, Mich.

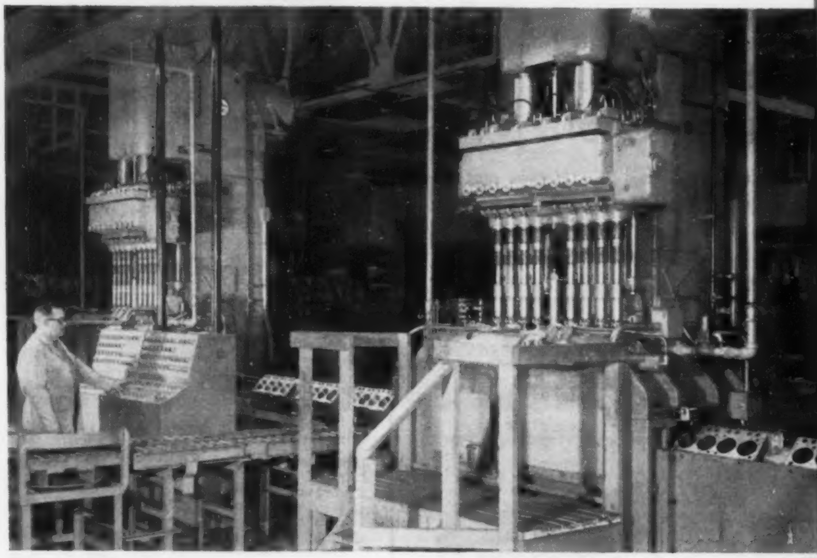
SHAPERS, Vertical and Slotters
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Rotary
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Famco Machine Co., Kenosha, Wis.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

This is the first! This is New!



Production honing with EITHER WATER SOLUBLE or KEROSENE base coolants with JES-CAL Hones

Jes-Cal rigid shaft, size control honing tools are the first and only honing tools yet developed which have been used in production EITHER with water soluble or kerosene base coolants! In the opinion of production personnel in one of the oldest and best known automobile manufacturing plants this fact has been established after years of exhaustive and comprehensive research and production development.

The advantages of water soluble honing coolants? Look at these:

1—The coolest, stock removing processing ever seen in high production — no after-distortions due to heat dissipation — accuracy consistently held within 0.0003 to 0.0004-inch for roundness and straightness — need for inspection practically eliminated.

2—Bore size held consistently and dependably within 0.0003-inch — only spot checking maintained — Jes-Cal taper gauges permit accurate, selective control of bore sizing to maintain adjustment with piston production.

3—The safest, cleanest honing ever accomplished — no fire hazards — no skin burning — no smoke shrouds — pleasing rather than unpleasant odors — all working conditions substantially improved.

For further information, write to:

JES CAL

JES-CAL COMPANY
31485 GROESBECK HIGHWAY • FRASER, MICHIGAN

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SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK

Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SHOP FURNITURE—See Furniture, Shop

SLITTING MACHINES, Rotary

Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

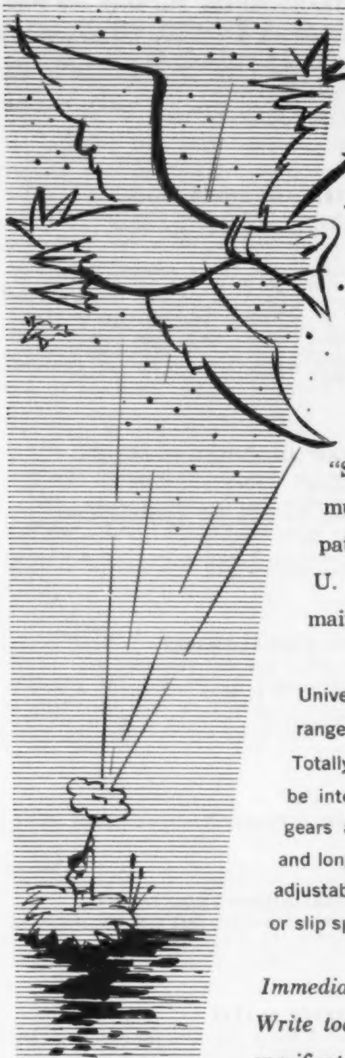
SOLENOIDS

Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Ceveland 2, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

(Continued on page 348)



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Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
DoAll Co., Des Plaines, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

SPINDLES, Machine

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. St., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio
Wadell Equip. Co., Clark, N. J.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal

Dayton Rogers Mfg. Co., Minneapolis, Minn.
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS

Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES

Cyril Bath Co., Solon, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Pa.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Challenge Mchy. Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
South Bend Lathe Wks., South Bend 22, Ind.

SWITCHES, Limit

Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

SWITCHES, Rotary

Daven Co., The, Livingston, N. J.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

TAPPING HEADS

Boice-Crane Co., Toledo, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
LaSalle Tool, Inc., 3480 E. Outer Drive, Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio
Chicago Pneumatic Tool Co., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
LaSalle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
Western Machine Tool Works, Holland, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPS, Hand, Machine Screw, Pipe, etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hy-Pro Tool Co., New Bedford, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD CUTTING MACHINES

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Dayton 1, Ohio

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
National Machinery Co., Tiffin, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Dayton 1, Ohio
V & O Press Co., Hudson, New York

TOOL CONTROL BOARDS

Cross Co., 3250 Bellevue, Detroit 7, Mich.
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Kennemetal Inc., Latrobe, Penna.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Walton Co., Hartford 10, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Haynes Stellite Co., 725 So. Lindsay St., Kokomo, Ind.
Lovejoy Tool Co., Inc., Springfield, Vt.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metal Carbides Corp., Youngstown 12, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Vanadium Alloys Steel Co., Latrobe, Pa.

TRACING ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio.
Atlas Press Co., Kalamazoo, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Sidney Mch. Tool Co., Sidney, Ohio
Wales-Strippit Co., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

TRANSMISSION, Variable Speed

Allis Chalmers Mfg. Co., Milwaukee, Wis.
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland 4, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling

Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio

TUBE-FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES

Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBE MILLS

Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBING, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., Beaver Falls, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Melon Square, Pittsburgh 22, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio

TUBE & PIPE CUTTING-OFF MACHINES

Grieder Industries, Inc., Bowling Green, Ohio

ULTRASONIC MCH. TOOLS

Sheffield Corp., Dayton 1, Ohio

VALVE CONTROLS

Barnes, John S., Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air

Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic

Barnes, John S. Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hts. Blvd., Detroit 20, Mich.

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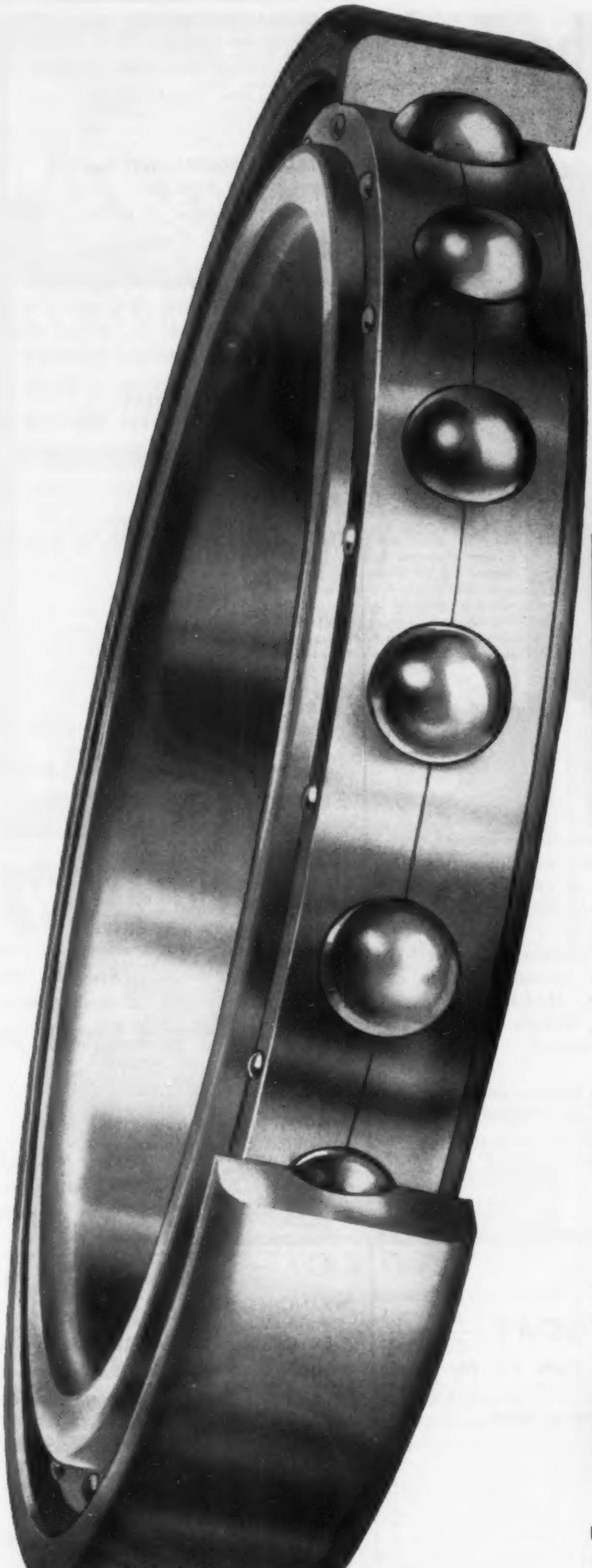

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Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Linde Co., New York 17, N. Y.

WELDING EQUIPMENT, Gas

Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., New York 17, N. Y.

WELDING EQUIPMENT, Resistance

Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio

WELDING POSITIONERS

Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS

Bliss, E. W., Co., Canton, Ohio
Mahon, R. C., Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS

Scott Paper Co., Chester, Pa.

WIRE

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.) 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Nilson, A. H., Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WOODWORKING MACHINES

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Onsrud Machine Works, Inc., Niles, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Power Chuck

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.

WRENCHES, Torque

LaSalle Tool, Inc., 3480 E. Outer Drive, Detroit 34, Mich.

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No. 5T Sellers, m.d.
No. 6G Sellers, m.d.
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No. 13 Brown & Sharpe Universal Cutter Grinder, m.d.
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No. 4 Stevenson O.B.I. Punch Press, direct geared fly-wheel drive
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Model H Cleveland O.B.I. Punch Press, belt drive
No. 1 Robinson O.B.I., belt drive
No. 68B Niagara Straight Sided Single Geared Double Crank
No. 164½ Toledo Toggle Drawing & Deep Stamping
No. H3 Niagara Horn Press, single back gear
20 ton Oilgear Gooseneck Assembly Type Hydraulic
No. 3 Bliss Single Crank Open Back Inclinable, m.d.
7½ ton French Oil Mill Machine Co. Straightening, m.d., 1942
No. 50—5-84 Minster Straight Side Double Crank Single Geared Press, belt drive

SAW

Campbell Abrasive Cut-off, m.d.
No. 4B Robertson Economy, m.d., new
No. 4XB Robertson Economy, m.d., new
6 x 6" Peerless Hack Saw
No. 32B Cochran Bly Saw, m.d., latest
Model 401 Cutomatic Abrasive Cut-off, m.d.
U 13 Peerless Universal Type H.S. Metal Saw, m.d.
Do-All Metal Cutting Band Saw, Z-V-60-26, m.d.
Model 102, Type J.C.A.W. Cincinnati Elec. Tool & Abrasive Cut-off, m.d.

ENGINE LATHES

12"x40" centers American, m.d.
13"x42" centers LeBlond "Regal", m.d.
13"x48" centers Pratt & Whitney, m.d.
14"x8' bed, 61⅛" centers, American Heavy Duty, m.d.
14"x30" centers Lodge & Shipley, m.d.
14"x30⅛" centers Lodge & Shipley, m.d.
14"x31½" centers Lodge & Shipley, m.d.
14"x32¾" centers Springfield, m.d., taper
14"x33" centers Sidney, m.d.
14"x33¼" centers Lodge & Shipley, m.d.
14"x34" centers LeBlond, cone
14"x36" centers LeBlond Geared Head, s.p.d.
14"x36" centers Monarch, motorized, cone
14"x36" centers Pratt & Whitney, cone
14"x54" centers Reed Prentice Geared Head, m.d., late
16"x28¾" centers Hendey Yoke Head, m.d., taper
16"x29½" centers Lodge & Shipley Selective Head, m.d.
16"x29⅝" centers Monarch Geared Head, m.d.
16"x30" centers American High Duty, m.d.
16"x30" centers Monarch Model CY Toolmakers, m.d., Keller Attachment
16"x30" centers Monarch, m.d., taper
16"x30" centers Monarch, Model CW, m.d.
16"x30" centers Hendey Geared Head, m.d.
16"x36" centers Lehmann, m.d.
16"x102" centers American High Duty, m.d.
16"x30" centers Reed Prentice, m.d.
16" (actual swing 16¾") x 52" centers Monarch, m.d., taper
16"x54" centers Monarch, m.d., taper
16"x55½" centers Monarch, m.d.
18"x30" centers American, m.d., 8 speed
18"x39" centers Greaves-Klusman, m.d.
18"x48" centers Lodge & Shipley, m.d.
18"x49" centers Lodge & Shipley, m.d.
18"x51" centers American Geared Head, m.d.
18"x51" centers Hendey Geared Head, m.d., taper
18"x54" centers American, m.d., Timken
18"x60" centers Cincinnati Tray Top, m.d.
18"x72" centers Cincinnati Tray Top, m.d.
18"x106" centers (110" centers tailstock overhang) American, m.d.
19"x48" centers LeBlond Geared Head, Timken, m.d.
19"x68" centers LeBlond Geared Head, m.d.
20"x46¾" centers Lodge & Shipley, m.d.
20"x48" centers Boye & Emmes, m.d.
20"x55" centers Greaves-Klusman, m.d.
20"x70" centers American, m.d., taper
20"x72" centers Boye & Emmes, cone, motorized
20"x72" centers Boye & Emmes, m.d., taper
20"x77" centers Sidney Geared Head, m.d.
20"x168" centers Boye & Emmes, m.d.
21"x42" centers LeBlond, m.d., taper
24"x51¼" centers Lodge & Shipley, m.d., taper
24"x75¾" centers Lodge & Shipley, m.d.
24"x84" centers Boye & Emmes, cone
24"x84" centers LeBlond, m.d., taper
24" (actual swing 24½") x 94" centers American, m.d.
24" raised in sand to swing 32"x192" centers New Haven, cone, taper
20"x10' centers Boye & Emmes, 1 year old
20"x192" centers American Pacemaker, m.d.
25"x49" centers LeBlond Geared Head, m.d., taper
25"x84" centers Reed Loose Change, cone
25"x120" centers LeBlond, m.d., taper
25"x20" centers Boye & Emmes, 1 year old
27"x96" centers American H.D., m.d., late
30"x76" centers Niles-Bement-Pond, m.d., taper
32"x23' centers Boye & Emmes, m.d.
42"x31'-1½" centers, American H.D., m.d.
42"x85½" centers American, m.d.

The above is only a partial listing
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THE EASTERN MACHINERY COMPANY
1006 Tennessee Avenue, Cincinnati 29, Ohio • MElrose 1-1241 • Cable Address EMCO

QUALITY USED MACHINE TOOLS

1¾" 5 spindle Warner & Swasey Model M-2500 automatic 15 HP, MD, new late 1954
No. 3 S Gisholt dynetric balancer
Excello Model 61, 6 spindle vertical cylinder borer, new 1946, hydraulic feed
6 ton 36" stroke Colonial Model VA2-6-36-D-2-0 dual ram, heavy duty, vertical, hydraulic surface broach
10 ton 54" stroke American duplex vertical hydraulic surface broach
10 ton 66" stroke Oilgear type XD-20-66 double slide vertical surface hydraulic broach
Modern Model 2A automatic cut-off machine, new 1951
Model 401 Campbell Cutomatic 6" abrasive cut-off
Model 420 W. F. & John Barnes horizontal deep hole drilling boring machine
No. 20 H. O. Baker hydraulic feed drilling and boring machine, presently with 8 spindle multiple drilling head
Davis & Thompson rotomatic Model 8LV vertical drill with 8 spindle head
Model BL 2416 Pratt & Whitney keller machine with 3 spindle head, new 1941.
24" Gleason bevel gear planer, well equipped
Type A Barber Colman standard gear hobbing machine, new 1944
10" x 18" Norton type C semi-automatic plain hydraulic cylindrical grinders (3)
14" x 36" Landis type C plain cylindrical grinder, late
30" No. 84A Gardner opposed wheel double disc grinder, new 1947
52" No. 124 Gardner vertical spindle horizontal disc, 1944
8" x 24" No. 3 S Abrasive horizontal spindle surface grinders, (2)
16" x 30" centers 6' bed Reed Prentice Model AA geared head engine lathe

ASK FOR YOUR ILLUSTRATED STOCK LIST NO. 207.

MILES MACHINERY CO.
PHONE SAGINAW PL 2-3105
2045 E. GENESEE AVE. SAGINAW, MICH.

LARGE LATHES FROM STOCK

Betts-Bridgeford 26" x 31' cc Geared Head—Hole through spindle 5"—Two-section bed

Lehmann 30" x 22' cc "Hydrotrol" Geared Head—Speeds to 410 RPM

American 36" x 15' cc Geared Head—Speeds to 400 RPM—Taper attachment

Monarch 36" x 132" cc Heavy Duty Geared Head—Speeds to 303 RPM—Taper attachment—1944 machine

LeBlond 48" x 108" cc Heavy Duty Geared Head—Speeds to 165 RPM—1943 machine

Swing can be increased and be lengthened as desired on any of these lathes.

BOTWINIK BROTHERS OF MASS., INC.
14 Sherman St.
Worcester 1, Mass.
tel: PLeasant 6-5175

MACHINE TOOLS

No. 56-90 Cincinnati Duplex Hydro Mill, 1942.
6 Spindle 20" No. 2LMS Leland Gifford Drill
3' x 11" 3' x 13" Cincinnati Bickford Super Service Radial Drill.
No. 3 CINCINNATI H.S. D.T. Horiz. Mill, NEW 1945. Extra table travel, vert. heads.

FALK MACHINERY CO.
19 Ward Street—BA 5-5887—Rochester, N. Y.

POSITION WANTED

Young (26), alert industrial tool and machinery salesman desires factory representative post. 5 years production line with major industrial manufacturer, 1 year sales with leading industrial distributor. Will relocate in Midwest area. Married. If you want an ambitious self-starter who understands your customer's needs and problems write **Box 713, Machinery, 93 Worth St., New York 13, N. Y.**

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Detroit firm seeking sales representatives for electrical control panels and hydraulic power units, individual or combined electrical and hydraulic controls for machines and automation. Complete engineering service and literature available. Address inquiries to
Machine Tool Control Corporation
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MACH. SHOP-FABRICATION. S.W. LOUISIANA Price $49,500 Incl. inv. eqpmt. fixt. R.E. & 3 bldgs. G. poten. compet. nil. Xlnt loc. estab. accts. Ref. B-9617

ORNAMENTAL METALS—Cen E Fla Coas. Design-fabricate iron, aluminum, bronze. Absentee own. nets $24,000. Pot unlim-estab client 100 mi rad. A-1 eqpt-roll stck. Alum-steel concrete bldg. opt. A beauty for aggress, active exp. man. Ask $80,000. Write B9626.

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Machine Tool Publications
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S & S MACHINERY CO. seeks top-drawer machine tool salesmen with successful backgrounds in selling new equipment. Areas throughout the country open. Send full particulars first letter to: **NEW EQUIPMENT DIVISION, S & S Machinery Company, 140 53rd St., Brooklyn 32, N. Y.**

ROOFE *Heavy Duty* BULL NOSE CENTERS

guarantee perfect alignment

Accuracy, dependability, and economy are watchwords in the manufacture of Roofe Live Centers. That's why users come back again and again. Double rows of ball bearings in the large and small ends of Bull Nose Centers make perfect alignment *positive* on your work.

Two shank sizes provide diameters from ½" to 7½" for a variety of work with a single center.

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large die area

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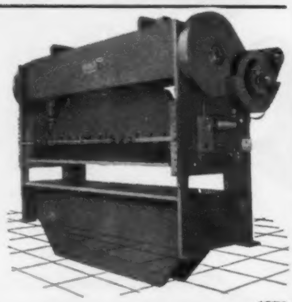

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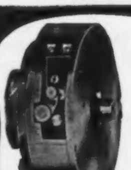

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M-D facing Head feeds automatically. Lathe tool bit travels radially from center outward or reverse. 10 sizes, 6" to 46" dia. Write for bulletin, prices.

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DO YOU BEND? CUT?

"A MANUAL OF PROCESS for THE COLD BENDING OF METALS and ABRASIVE CUT-MACHINING OF METALS" gives practical advice on all phases of cold bending and abrasive cutting. Simply written by shop men for shop men. Price $2.50.

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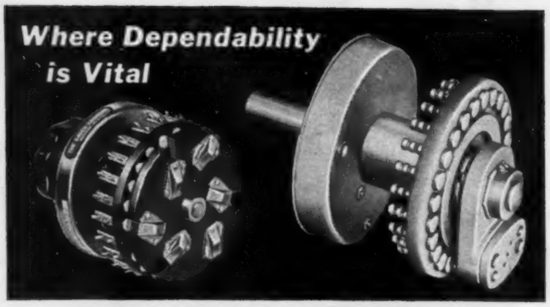

Daven Rotary Switches Are Specified

HERE'S WHY:

- **Patented knee-action rotor**—ensures low, uniform contact resistance, trouble-free operation.
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DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

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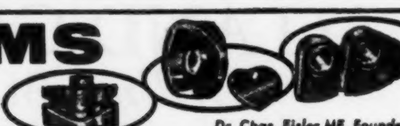

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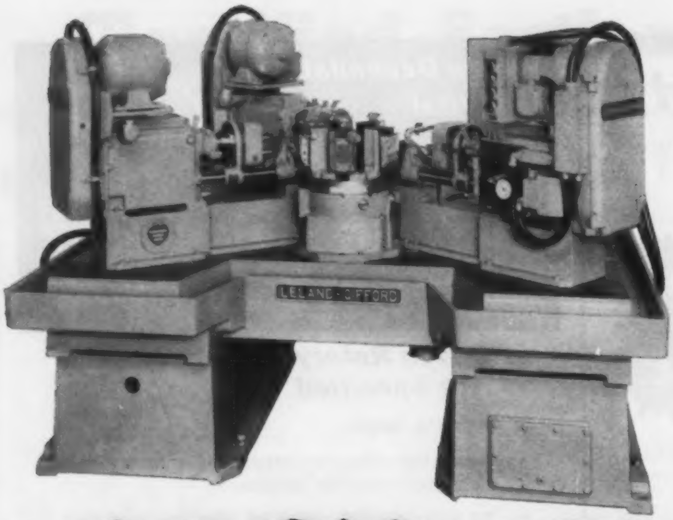

Mechanize Hand Operations

THE JOB — Drill and ream four holes on the face and two ends of automatic transmission valve body.

THE SETUP — Three No. 2 self-contained deep hole units with 2-spindle multiple heads and a 5-station hydraulic indexing station. Production: up to 120 pieces per hour.

LELAND-GIFFORD *Special Drilling Machines*

THE JOB — Drill and ream two .750/.751 dowel holes in 4 and 6-cylinder engine blocks.

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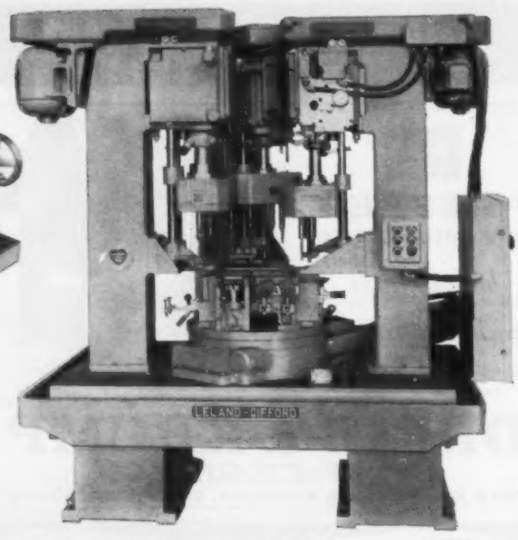

THE JOB — Drill and ream 9 holes in one face and 2 deep angular holes in one side and one end of a control valve housing.

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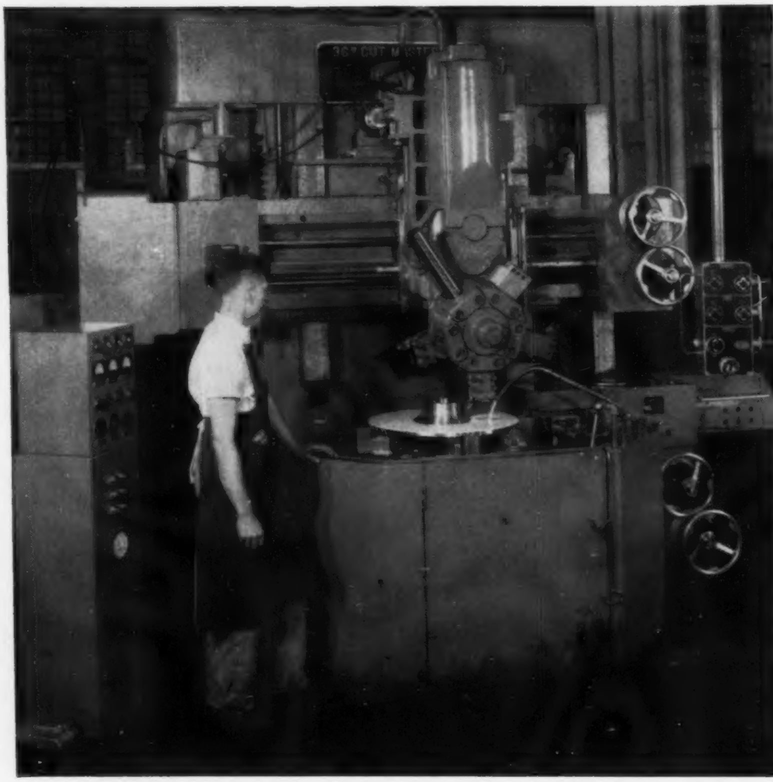
TIMKEN® bearing equipped . . . 1 lathe replaces 4, cuts machining time 81%



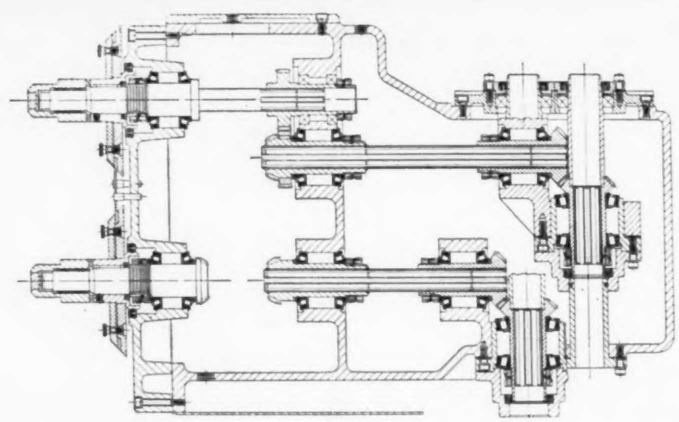
THIS new Bullard 36" Cut Master Vertical Turret Lathe, turning out hub discs and cover discs for turbo wheels at the York Corporation, York, Pa., has cut machining time an average of 81%. And does all the operations formerly done on 1 horizontal turret lathe, 2 engine lathes, and 1 older vertical turret lathe! Timken® tapered roller bearings play a major role in this production story.

16 Timken bearings in the hand wheel bracket—and other Timken bearings in the headstock and feed works—maintain precision, locate shafts and gears, hold integral parts in accurate alignment. Reduce wear.

Maintenance costs are low, with Timken bearings built to last the life of the lathe. Friction is practically eliminated, conserving power. Timken bearings are geometrically designed, precision-manufactured, to give *true rolling motion.* To insure highest quality, we even make our own fine alloy steel—which no other American bearing maker does.

Look for the trade-mark "Timken" on each bearing! The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **THE BULLARD COMPANY** mounts 16 Timken tapered roller bearings in the Hand Wheel Brackets of their vertical turret lathes.

TIMKEN TAPERED ROLLER BEARINGS ROLL THE LOAD

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